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THE FUNCTIONS AND ORGANIZATION OF THE AMERICAN SOCIETY OF NATURALISTS[1]

THE American Society of Naturalists was founded, under the name of The Society of Naturalists of the Eastern United States, in 1884, by a group of the leading biologists of the day. Some of these have long since passed away. Others yet remain with us and are among the most active and most distinguished representatives of biological science in America to-day.

The motives underlying this movement are not difficult to discover. They are to be found in the great trend toward an intense specialization which at that time began to attract wide-spread attention and called for great concentration of effort and more exacting methods; in the rapid development of a refined and precise technique; in a growing demand for improved science teaching in schools, and in an appreciation of the fact that the arbitrary distinctions hitherto maintained between the two great schools of biological research must shortly disappear in joint efforts toward the solution of the great problems of life. The logical outcome of this point of view necessitated careful consideration of the relations in which the new order of scientific thought and progress must stand toward methods of research and the constitution of societies and academies of science.

But above all, it became a matter of first importance to determine the relations of the new order to the rising generation and through them to the future specialist and scientist. In other words, it became clear that the methods of science teaching must

[1] Presidential address delivered at the Baltimore meeting, December 31, 1908.

be made to so far conform to the trend of scientific thought and to actual progress, as to secure to the public at large correct conceptions, and to the future student of science a proper basis on which to found more advanced studies. It is, therefore, in no way surprising to find that some of the very first discussions of the newly formed society were directed toward a careful consideration of "methods of teaching" and "the employment of specialists by the educational institutions of the country."

It is not our present purpose to analyze fully the important influences which have extended from these discussions broadcast over the land, carrying with them the full weight of the highest authorities of the day, as it would take us altogether too far from the immediate purposes of this address; but it is, nevertheless, worth our while to point out that the spirit of cooperation in scientific endeavor, the high purpose to influence and improve the standard of scientific thought and effort, and the intention to so dignify and enrich scientific achievements that the society might stand as an exponent of the highest and best scientific thought, and as an inspiration to the rising generation, were ideals which constituted the fundamental concept and have been adhered to during the quarter of a century of usefulness which has marked the career of this institution. It was in this spirit that the society set before itself lofty ideals of usefulness, and in the period that has since elapsed I fail to discover that there has been any retrograde step or any serious lapse from the first declaration of policy. The only opportunity for criticism would appear to lie in the possibility that this policy, while fully maintained, has not proved sufficiently elastic to permit of ready adjustment to altered conditions imposed by the lapse of time and the progress of scientific thought; but I am not prepared at this time to admit that such is, in reality, the case.

This society numbers, to-day, 376 members, among whom we proudly reckon the majority of the leading scientific men of the country, while in its organization it represents a powerful, coordinating and centralizing body for various groups of specialists joined for their particular purposes into small societies devoted to restricted lines of research. Few will venture to deny the preeminent position the society occupies, the great influence it has exercised or the eminent character of its work. Nevertheless, we are suddenly faced with a grave problem which threatens nothing short of the very existence of the organization.

Within the last two years we have heard much to the effect that the society is in a moribund condition, that its usefulness is a thing of the past, and the faint-hearted even insist that it is time for it to gracefully die. These statements have been repeated with such insistence and frequency, in spite of the firm belief of many that the society has a very definite and important function to perform, and that never in its history or in the history of science, was there a time when its efforts and influence were more needed than now—that the more progressive, and, I am also bound to say, the more thoughtful among us are led to consider the situation as one which requires to be dealt with firmly but without further delay, to the effect that the usefulness of the society and its functions must be redefined in the light of present-day needs and present-day conditions, and that it shall be rehabilitated. Or, failing this, that it shall be promptly and finally relegated to the things that have served their purpose and no longer meet a want in the economy of scientific thought and development—that its career must be terminated. This is the direct issue with which every member of

this society is faced to-day, and the result must be determined by the vote which you will presently be called upon to cast.

My task is certainly not a congenial one, but as your president to whom the issue has been presented in a most unexpected manner, it is my duty to bring before you as clear an analysis of the situation as it is possible for me to give, and then leave the final decision in your hands.

In the last presidential address delivered to this society, Dr. McMurrich defined the great function of the Society of Naturalists in a very concrete but comprehensive phrase, when he said that "It makes for the solidarity of those sciences which, in the older days, were included in the term natural history," and he then proceeded to show how the necessary development of the biological sciences in particular wrought a change in the work and character of the society, and even threatened to obliterate its *raison d'être*. It is not my purpose to enlarge upon the line of thought which these remarks naturally suggest, but rather to employ them as the starting point for further consideration of those activities which properly devolve upon an organization of this kind, to indicate further directions of usefulness, and, if possible, convey to the minds of my hearers some small measure of that conviction which assures me that there is, more than ever, an open, fertile and as yet unoccupied field which it should be our special duty to cultivate in the interests of pure science.

One of the essential features in the activity of the Society of Naturalists has been the opportunity for the unreserved discussion of abstract scientific problems in which specialists alone are competent to engage, and who alone could derive benefit from such deliberations. Complete removal from the distractions of social life and large public gatherings, are conditions essential to success, and these conditions have been met in the past by placing the meetings at the time of the mid-winter recess when members could find a few days of relief from their professional work. So long as these conditions were observed, the work of the society was not only successful, but it commanded wide consideration and respect, and there was an atmosphere of enthusiasm and *esprit de corps* which made membership a thing to be sought for and valued.

The American Association has been accustomed from the time of its organization to hold its meetings in summer, usually the latter part of August or early September. In 1902, however, for reasons which we need not stop to analyze or discuss at this time, the association resolved to hold winter meetings, and to make these events synchronize with the meetings of the Naturalists. By many this unfortunate step was viewed with alarm, since they clearly perceived that there could never be room for two such bodies, occupying such distinct fields of endeavor, and with such distinctive methods and objects, in joint sessions, and that sooner or later there would be dissatisfaction and one must yield.

The American Association, by reason of its very constitution, must always remain distinct and apart from the Society of Naturalists. The two organizations occupy distinct spheres of usefulness which should not be compromised by being brought into too close contact, and it is well that this relation should not only be recognized but maintained, since in that way alone may they strengthen and supplement each other's work in the most effective manner. The great purpose of the American Association is to popularize scientific knowledge and effect its widest distribution. In this way it aims to secure for scientific men the widest recognition and the most perfect facilities for their work. It seeks, therefore, first of all, to gather about a relatively small nucleus of scientific men, the largest

possible popular membership collected from the population of the town or city in which its meetings may be held. No one would think of questioning the value of such a proceeding for the particular purposes of the association, but it will be readily admitted by all that such methods are not in harmony with the purely scientific spirit, that they are inconsistent with sober scientific thought, and that the meetings are not expected to be productive of the best results of investigation. Indeed, it is a matter of common repute that the meetings of the association are not the places for specialists to give serious attention to the problems they are endeavoring to solve, but rather that they afford convenient opportunities for cultivating the social side of scientific life. All this is eminently praiseworthy and desirable, but such work must not be confounded with or allowed to intrude upon opportunities for purely scientific deliberations.

Members of the Society of Naturalists are also in most, if not in all cases, likewise members of the American Association. In such joint membership there is nothing which need imply antagonism or duplication of work, but, on the contrary, such a perfectly natural relation should operate to the advancement of each, particularly of the latter association, by bringing to its ranks the very scientific strength it requires in the execution of its chief function—the popularization of scientific knowledge.

Since the institution of joint meetings there has been a growing feeling that it is impossible to do justice to both interests, that in the multiplicity of sections and societies, of meetings and social functions, there is left no opportunity for the sober work of the Naturalists which has, in consequence, resolved itself into a perfunctory discussion of some large problem of immediate interest. The most recent phase of this particular aspect of the question is found in the fact that other bodies are now entering this field and thereby tending to still further diminish the value of the work originally undertaken by the Naturalists, through useless duplication and dissipation of energy. The members feel that their time is not being occupied in the way they could wish; that they do not gain from their colleagues the interchange of ideas and experience they had hoped for. Under such circumstances dissatisfaction soon follows; fading enthusiasm treads hard upon the heels of fleeting ideals, and we shortly hear of moribund conditions; references to the greatness of the past and dismal forebodings for the future, coupled with the hope that the society may soon disband. These results must be regarded as the logical expression of forces set in motion when it was decided to establish joint sessions, since it has been observed that during the six years this relation has been in operation, there has been a gradual waning of interest in the public debates, which have also exhibited diminishing importance and force as the leading function of an important scientific body.

It is worth while to recall in this connection that the institution of joint sessions did not affect the Naturalists alone, but involved the Geological Society and all those specialists' societies in affiliation with the Naturalists. From these, complaints and protests are already beginning to be made, and I have it on the best of authority that at least one society is now considering what measures it shall adopt to counteract the undesirable situation in which it finds itself.

It is quite possible that a feeling of indifference or of complacency may have developed among a certain section of the society, and that in the annual house-cleaning which is supposed to take place with the installation of a new executive, there has not been sufficient removal of the waste

of previous years, and a proper introduction of that fresh atmosphere which brings with it renewed endeavor, a broader and more hopeful outlook and the inspiration to new activities and new conquests. I say this because we must be quite sure that neither the whole fault nor even a part of it lies with ourselves. But viewing the progress of events in the light of this qualification, as well as of the fact that we do not stand alone in our dilemma, the conviction is forced upon us that our difficult situation is primarily and chiefly due to the anomalous relations which have been established between us and the American Association. It appears to me, therefore, that while the general sentiment has forced conclusions based upon the alternative of a revision of our relations to that body or extinction, the real issue should be stated in terms of continued companionship. To my mind there should be no question of the society abandoning its chosen field of usefulness in which it has won such distinction. The issue is a clear one and should be won or lost on the simple question as to whether we shall continue to meet with the American Association or choose our own time and place.

Never in the history of the biological sciences, using that expression in its most comprehensive sense, have there been such rapid, extended and far-reaching changes, both of thought and method, as during the last twenty years, and without assuming the rôle of a prophet, it is probably safe to assert that the next two decades will witness even more profound changes. A society such as this, therefore, should always hold itself in readiness to adjust itself to altered conditions, and while exercising a due conservatism, it should, nevertheless, be prepared to meet the situation imposed by altered points of view, new methods, fresh hypotheses, newly ascertained facts and proved generalizations. In such ways alone does it become possible to infuse new life into those whose ripe experience may excuse a certain degree of complacency; or to awaken enthusiasm in those who are at the threshold of the richest experience that can fall to the lot of man.

Our last president indicated in his address before the society, that the changes introduced by abandoning the generalized methods of the old school of natural history for the more specialized methods of the new school of science introduced some thirty years ago, shortly led to a cleavage between the biological sciences which extended to a similar separation of geology and paleontology. That botany and zoology should become more independent was regarded as both natural and unavoidable, and, from many points of view, most desirable. Viewing the cleavage of paleontology from geology, from the standpoint of efficiency in scientific development, and the normal relations of cognate subjects, we need express no feelings of regret, for however valuable the evidence of fossil forms may be to the geologist as a working force, there is no natural relation between the two. It has, however, been a slow and somewhat tedious process to gain recognition of the fact that paleontology is not a science in itself, and that it does not bear any direct or precise relation to geology; but that it is a composite subject whose chief members belong to the domains of zoology and botany. Were the results of this cleavage to be expressed in no more extreme form than what has been indicated, they might be regarded with seeming indifference, but, as in all reforms, the swinging pendulum has been allowed to continue too far on its one-sided course, and for years the biological sciences have suffered an unsymmetrical development which at times has given rise to many heart burnings and false conceptions of what the science really stands for. The lingering tendency to per-

petuate a distinct scientific status for each of the older subjects, without reference to their cognate relations, has found expression in the recent attempt to organize an independent society for paleontology, a movement which I conceive to be unscientific in spirit, at variance with the present tendency of the times, and one which should receive the prompt discouragement of this and every other scientific body.

When Huxley and Martin introduced their meritorious scheme of general biology, they can hardly be said to have deliberately contemplated the absorption of the entire science of life by either the zoologist or the botanist, but, unfortunately, such was really the outcome of the forces set in motion by them. The relative conditions of development in zoology and botany in their day were such as to lead to the natural conception that a course in general biology must consist of a major quantity of the former and a minor quantity of the latter. This arose from the recognized fact that the development of zoology had proceeded along advanced lines for many years, while botany was yet struggling with questions of taxonomy, nomenclature and general morphology so-called—concerning itself but little with the more important aspects of the subject. It was not until twenty-five years ago that plant physiology, pathology, paleobotany and ecology began to attract attention, either as important educational subjects or as departments of research likely to be productive of great scientific or economic results. It would have been contrary to all human experience had the zoologists failed to promptly seize and exploit the rich fields which lay before them, and botanists have only themselves to thank for the fact that the zoologists not only appropriated their rich inheritance, but delayed a recognition of their rightful share until within the last decade. Gratifying as the present progress in this direction may be, it is nevertheless far from satisfactory. In many cases our best educational institutions show a lingering conception that botany plays only a subordinate part in any general biological scheme, and that biology is substantially a knowledge of animal life only. Professors even openly advocate courses, or persist in maintaining courses in general biology in which this feature is given special prominence. Among the general public highly educated people commonly discuss botany and biology as wholly distinct and largely unrelated subjects, a point of view for which we can make some allowance when their leaders in science ignore first principles. Such persistent, and one might almost say willful, blindness to the proper correlation of subjects begets a disastrous confusion of ideas and intellectual sterility. Witness the recent instance of a medical practitioner in good standing, and only a few years out of a leading medical school, expounding to a public audience the principles of preventive medicine as applied to tuberculosis. His advice was good, but when he left the immediate field of his own profession for that of science, his statement that "*Bacteria are little animals about half way between a spore and a seed*" was far from comforting to those who had fondly hoped some fertile soil was to be found in the ranks of the rising generation of medical men, wherein to sow the seeds of correct biological principles.

The recently exploited work of Mendel and the brilliant achievements of de Vries, whose results are now being utilized so extensively by zoologists in elucidation of hitherto obscure problems, the light thrown on general biological problems by the long and brilliant array of investigations in plant cytology, the advances in plant pathology which have led to results of the greatest economic importance and have thrown a brilliant side light upon many

obscure problems in animal pathology, recent progress in our knowledge of the laws of hybridization and inheritance, and a dawning recognition of the place which paleobotany properly occupies—all indicate not only that the subject of botany is rapidly gaining its rightful position, but that zoologists are becoming more and more dependent upon a knowledge of plants for a clear and rational explanation of many phenomena of animal life. I do not desire to leave the impression that zoologists as a whole are given to cultivating the erroneous ideas I have endeavored to indicate, because, as a matter of fact, there are many of our leading animal biologists who cheerfully and freely recognize the great and important position of botany as a channel through which some of the most important laws of life receive their best exposition. But that there is certainly need of reform with respect to the general attitude of both our educational bodies and the general public can not be questioned, and that this society should lend its influence in this direction I conceive to be among its most important functions.

The present tendency in science, received as a legitimate inheritance from the great upheaval of the latter part of the nineteenth century, is toward an undue specialization, and an undue haste to attain to the positions occupied by the older men of the professions. The introduction of the system of unrestricted options so fashionable a few years since, has led to efforts to specialize in the undergraduate course, a tendency which still receives far too much encouragement on the part of those whose experience and position should lead them to advise otherwise. My attention is more particularly directed to this with respect to the biological sciences for which a thorough grounding in chemistry, physics and geology is not only indispensable, but because such fundamental knowledge becomes more essential with every fresh advance that is made. The more deeply one specializes, the greater the need for that help which comes from other fields of learning. Plant physiology demands an accurate and somewhat extensive knowledge of both physics and chemistry. Pathology, to be profitable, must be studied from the comparative point of view. Paleobotany demands an extensive knowledge of geology. What is true of the science of plant life is more or less true of the sciences which deal with life in any one of its numerous phases. For the broad foundations in general science thus required, our educational institutions must provide opportunities for all-round and thorough training, and the present tendency to an early and undue specialization must yield, as it is already giving way to, a more rational group system. Above all, students must be brought to realize that a patient apprenticeship through which the successive steps are taken with deliberation and on the basis of thorough knowledge, is the only medium through which to secure the highest reward and the greatest satisfaction when the goal is finally attained.

Specialization, however, is not confined to individuals, but extends to societies and not only tends to lead them too far from the central idea of coordination, but involves an undue multiplication of organizations engaged in essentially the same lines of work. Such duplication is as unnecessary as it is deplorable.

Specialization is recognized as a necessity of modern scientific development, but its unrestricted exercise involves lack of coordination, narrowness of view, unsymmetrical development. While we fully agree with Dr. Farlow, as expressed in his presidential address before the American Association, that the object of scientific organization is to encourage diversity of work, he would undoubtedly agree with our point

of view that in exact proportion to such diversification or specialization, does it become of increasing importance that there should be a strong, centralizing power operating for breadth of view, coordination of results and a symmetrical development.

Under its present organization the Society of Naturalists is the coordinating and centralizing force for eight other societies which represent the work of specialists in their several fields of activity. These are: The American Anthropological Society, The Physiological Society, The Psychological Society, The American Society of Vertebrate Paleontologists, The American Society of Zoologists, The American Society of Anatomists, The Botanical Society of America, The Society of American Bacteriologists.

It would be a very fitting and natural association if to this important group there were added the Geological Society of America, whose deliberations involve so much in common with some of the other societies, and we may indulge the hope that such a union may be realized in the near future and be so extended as to embrace all of the other specialists' societies not represented at this time. With one or two exceptions this group may very well be regarded as an ideal division of activities without undue subdivision or duplication of work. The only ground for real criticism might be found in the separation of the vertebrate paleontologists from the zoologists, and of the bacteriologists from the botanists. With respect to the former I may reserve my remarks for another connection. With respect to the latter, it might seem better on general grounds that the bacteriologists should be merged with the botanists; but when it is recalled that membership includes many who are not botanists in the general acceptation of that term, that a large number are physicians and zoologists, and that bacteriology involves a peculiar and elaborate technique, almost exclusively applicable to these minute plants in their various economic relations, it must be conceded that here, at least, there are special reasons for a subdivision which, on other grounds, would not be justified.

It is obvious that specialization among societies may readily be carried too far—much beyond the bounds of scientific requirements. Among botanists this view has made great headway during the last ten years. Thus it is now generally agreed that a satisfactory knowledge and treatment of the science demands familiarity with the extinct forms of plant life, quite as much as with existing types. The methods involved in the study of fossil plants are essentially the same as those applied to the anatomy of recent plants. It is true that a certain and often detailed knowledge of geology is essential in this connection, but this does the botanist no harm and is more likely to be beneficial. The more we are called upon to deal with questions of phylogeny and evolution, the more essential does it become that fossil botany should be as familiar as recent botany. The two are, in fact, inseparable. It becomes clear, therefore, that it is an utterly false conception which endeavors to perpetuate the idea of a separate science of paleobotany. To encourage such a division is to retard the development of the science as a whole, and I am of the opinion that the remarks which apply to botany in this respect must also apply with equal force to paleozoology. No better service to the cause of consolidation, unification of interests and cooperation has been rendered in recent years, than by the union of the Society of Plant Morphology and Physiology and the Mycological Society of America, with the Botanical Society of America. These societies enjoyed separate existence for several years by reason of special circumstances which no longer exist. That the Botanical So-

ciety of America alone represents all the most important botanical interests of the country is a matter for congratulation.

Under the present system of joint meetings, or, as stated in the most recent official announcement, "under the scheme of affiliation" now in force, the following relations exist between the American Association and the Society of Naturalists, together with the various specialists' societies. Placing the latter in parallel columns with the former, it will be seen at a glance to what an extent there is duplication of work and a conflict of interests between the purely popular side and the purely scientific side.

AMERICAN ASSOCIATION	SOCIETY OF NATURALISTS
A—Mathematics and Astronomy	American Mathematical Society.
B—Physics	American Physical Society.
C—Chemistry	American Society of Biological Chemists. American Chemical Society.
D—Mechanical Science and Engineering.	. . . .
E—Geology and Geography	Geological Society of America. Association of American Geographers.
F—Zoology	Association of American Anatomists. American Society of Vertebrate Paleontologists. American Society of Zoologists. Entomological Society of America.
G—Botany	Botanical Society of America. Society of American Bacteriologists.
H—Anthropology and Psychology	The American Psychological Association. Southern Society for Philosophy and Psychology. American Anthropological Society. American Folk-Lore Society.
I—Social and Economic Science.	. . . .
K—Physiology and Experimental Medicine	Physiological Society.
L—Education.	. . . .
. . . .	American Philosophical Association.

The large number of specialists' societies here represented makes it clear that their separation from corresponding sections of the American Association for the Advancement of Science must be based upon the impossibility of properly conducting their work in such sections.

It is difficult to conceive what good purpose is served by announcing, let us say, that the American Physical Society will meet jointly with Section B (Physics) of the American Association. So far as the mere machinery of the meetings is concerned, there is an obvious saving of time and energy; but from the standpoint of scientific results, nothing can be gained for the simple reason that the majority of members of the Physical Society are also members of the American Association, Section B. From this it follows that the Physical Society would be simply meeting *with itself* while preserving the pleasing fiction that it was meeting with some other body.

Our analysis of the relations of the societies shows that there is not only an evident and unnecessary duplication, but that the work of one body interferes with that of the other; members often know not what meeting to attend; important papers are missed through unexpected changes of program and the impossibility of being in two places at once; confusion reigns supreme. It is clear that some radical and general readjustment of these relations is imperatively demanded in behalf of the general public whose interests are at stake, and for

the welfare of science, which is likely to suffer serious deterioration.

Apart from the considerations thus dealt with, there is another factor of great personal importance, since it bears directly upon the ability of the individual scientist to participate in the work of societies, and makes for the diminution of such organizations rather than their multiplication. In the pressure which is brought to bear upon the scientist to become a member of various societies, it is commonly overlooked that there is an absolute limit to his ability to meet the attendant expenses of such membership together with the ordinary requirements of his position and of his profession, and this limit is soon reached in the case of a large number of men. It was a recognition of this fact that led the Naturalists, some years since, to establish two branches, known as the Eastern and Western Branches, with such a form of organization as would enable them to meet separately or jointly as circumstances might determine. Few scientists are endowed with private means through either inheritance or marriage, and there are certainly several of the professions in which it would be impossible for them to amass even a moderate competency through the exercise of their technical knowledge.

Toronto, Chicago and Columbia have recently been enabled to advance their scale of salaries somewhat in accordance with the advance in the increased cost of living, but the great majority of institutions of learning adhere to the salaries which were barely adequate fifteen or twenty years ago. Taking the most common average salary at $2,000, an examination of the relations of a college professor to the responsibilities of his profession will probably justify the statement that he is called upon to expend from fifteen to twenty per cent. of his net earnings for the mere maintenance of his position without reference to the requirements of progress. "Low living and high thinking" finds neither place nor sympathizers under the present-day conditions, for he who would think high must not only be properly nourished, but his general environment must stimulate, not depress. We are in full accord with the attitude of a recent contributor to SCIENCE when he says:

> If we take $2,000 as the average salary of our college professors, we may say that on an average our professors will be drawn from homes where the scale of living is adjusted to the same figure. It should, therefore, be the aim of the college to pay such salaries to its professors as would enable them to give to their children what the college would regard as a perfect preparation for professional work. Only in this way can it draw its teachers from a class in which such preparation is possible.

The conditions indicated impose a grievous burden, and in the face of the education of children and support of families, it is often prohibitive of participation in those activities with which every scientific man should be identified. They carry with them also the additional burden of an undue strain upon the nervous system, and it is now a commonplace that the average professor is in a position of undue stress with respect to ways and means for the necessary expenses imposed by the position he holds, the maintenance of his family and the education of his children. It is within my own observation that this condition has more than once brought men to the verge of despair. It not only denies educated men of the very advantages they are expected to enjoy, but it places a premium upon celibacy and the imperfect education of children. These are not considerations in which sentiment forms a factor, but elements which are directly concerned in the best social organization. But, wholly apart from purely personal elements, putting the case upon the ground of correct business principles and business expediency, we may

safely ask if it is good business policy to engage the services of a highly trained man, impose upon him the most exacting physical and mental labor, and at the same time place him under conditions which compel him to expend from twenty-five to fifty per cent. of his nervous energy in attempts to meet situations altogether foreign to his professional work?

A confirmation of these views comes to us in a wholly unexpected manner through the death, on the twelfth of November last, of one of the most distinguished zoologists of the world. A man of singular modesty but charming personality, he saw in the needs of the younger generation demands which rose superior to all personal considerations. The story comes to us that much needed rest from most exacting labors was refused in the interests of his children. Who will dare say that we have not in this picture an exhibition of the highest type of noble self-sacrifice, and who is in a position to deny that he might yet be with us and prosecuting his work, had he been granted that pecuniary recognition which would have given him an opportunity for the proper care of his children without unnecessary hardship?

If the Society of Naturalists could lend its influence in the direction of an improved public appreciation of the services of the college professor, the real relation he bears to advancement in all departments of intellectual and industrial life, and a proper financial recognition of his services, it would confer upon society at large a benefit for which an adequate standard is difficult to find.

But I must hasten to direct your attention to the problem which demands immediate consideration, "How to find a remedy for the difficult situation in which the society is now placed?"

As the result of a very careful consideration at the hands of your executive body, and after obtaining a wide expression of views and some detailed plans, a proposition has been formulated which may serve as the basis of action by the society as a whole.

The general sentiment appears adverse to maintaining the society as a mere holding body. This opinion correctly indicates that the society must have some broader and higher function than that implied by an annual banquet and a public discussion. The various affiliated societies must be led to feel that there is a living force which brings them into harmonious relations with all kindred societies; that the central organization deals with the larger and broader questions in a spirit of coordination and in a way not possible to those engaged in the pursuit of specialties; that it lends its active influence in the promotion of research; that it is alive to the interests of the scientific professions, and that it has regard to problems of broad policy—in a word, that it is a living bond which makes for solidarity, community of interests, enthusiasm. The society should not only concern itself with the progress of science, but it is quite as much within its province to have regard for what may be called the economics of the scientific professions—the various conditions which affect the status, welfare and capacity of the individual.

In view of the overshadowing influence which larger and more popular bodies must necessarily exert, it is proposed that, hereafter, the meetings of the Naturalists shall remain independent of other general societies. This does not exclude the use of convocation week, but it does imply that we shall henceforth select some other time and place of meeting than that chosen by any society of a general and more or less popular character.

The present relations of specialists' societies to the Society of Naturalists is satisfactory in principle, though in practise

ways and means may be found to make it more advantageous to all than in the past. It is believed that under the proposed reorganization, it would be highly advantageous to include in the general scheme of affiliation all specialists' societies whose standard of membership is sufficiently high to conform to the requirements of the Society of Naturalists.

To further identify our interests with those of the specialists' societies, it is proposed that all matters of cooperation shall be dealt with by the executive committee, which shall be selected with a view to the establishment of such external relations. This phrase might well be interpreted to mean that each affiliated society shall have its chosen representative on the executive committee of the Naturalists, thereby ensuring the only relation between the several societies through which it will be possible to secure solidarity and identity of interests through cooperation.

It is designed to redefine the general policy in such a manner as to readjust it more definitely to the encouragement of research in the larger fields of science. It should be one of the first objects of our most earnest endeavor to secure a permanent fund which should be devoted to the encouragement of research by any properly qualified investigator within the limits of the United States and Canada, but the subject of investigation should fall within the field occupied by one of the affiliated societies.

The central idea of the society should find expression in some one line of endeavor which makes for the general progress of scientific thought. Of all the societies enumerated, which may be fittingly associated with the Naturalists, there is not one whose work may not be regarded as comprised in general biology, or as having an important collateral bearing upon that science. Whether expressed through the medium of the botanist, zoologist, physiologist or anatomist; through the more indirect channel of the anthropologist and the folklorist; or through the yet less direct channel of the chemist, the geologist or the physicist, the development of the earth, organic life and even thought itself, is the underlying motive for all. Evolution is, therefore, a great central idea which appeals to all investigators of natural phenomena, and this subject is suggested as one which should be the chief endeavor of the parent body.

In order to give working effect to this idea, it is proposed that each year original contributions dealing with one or more aspects of evolution should be presented to one or more meetings of the Society of Naturalists. Furthermore, it is regarded as desirable that there should be a presentation, annually, of reports upon the most important of recent works dealing with evolution. Both reports and the special contributions should be entrusted to men eminent in their respective fields of research. To occupy a position of this kind should imply a compliment.

It is believed that a general policy, wisely carried out, which keeps alive the enthusiasm for research in the ways indicated, would not only constitute a strong bond of union between the members of the entire organization, making for solidarity of interests, but that it would enlist the sympathy and cooperation of the younger generation of scientists.

D. P. Penhallow

McGill University

GEORGE WASHINGTON HOUGH

On New Year's morning, at about ten o'clock, occurred the sudden and unexpected death of Dr. George W. Hough, director of the Dearborn Observatory, at Evanston, Ill. Death came suddenly and painlessly to him, in the way that he had always hoped for it,

after he had come to fulness of years without any break in his intellectual vigor.

He was born at Tribes Hill, N. Y., on October 24, 1836. His ancestors on both sides were German, and old settlers in the Mohawk Valley, the first Hough having come to this country in 1730 from Würtemburg.

Professor Hough was a born astronomer, and grew up filled with the idea of following that profession; it is said that at nine years of age he constructed a contrivance from fish-poles for measuring the right ascension of a star. His mechanical genius, which he inherited from his father, also became manifest about this time, and he harnessed up a small brook to do his mother's churning.

After completing the course in the graded schools and the Seneca Falls Academy, he entered Union College at Schenectady, N. Y., where he graduated in 1856 with high honors.

After graduation he became principal of the first ward school in Dubuque, Iowa, where he remained until 1858, when he entered Harvard University for post-graduate work, taking the degree of A.M. in 1859. The same year he became assistant astronomer at the Cincinnati Observatory.

In 1860 he went to the Dudley Observatory at Albany, N. Y., as assistant astronomer, and two years later was appointed director, which position he held until 1874. It was at the Dudley Observatory that a large amount of his valuable work was done.

His astronomical work consisted largely in the observations of the declination of stars compared with Mars, observations of the planet Neptune, and of asteroids, and observation of Nautical Almanac stars, standard zone stars and small planets.

He invented at this time a machine for cataloguing and charting stars, the principle of which depends on the magnifying by mechanical means the angular motion of the telescope.

In 1867 he began work on the measurement of Struve's list of close double stars, and during the same year made a long series of investigations to determine the amount of the personal equation in transit observations. He made, besides, valuable observations on the rate of the sidereal clock, and the compensation of the pendulum.

A large part of his time and attention at the Dudley Observatory was given to meteorological work, and in 1865 he invented his recording and printing barometer. The principle of this instrument consists in the transmission of changes in the level of the mercury, by a float resting on the surface of the mercury in the short arm of a syphon barometer. The movements of the float are transmitted by electricity to the moving parts of the mechanism, which repeat this motion and record it. His reports show that more than 50,000 barometer observations were made with this machine in five years. He was awarded a gold medal for this instrument at the Centennial Exhibition in Philadelphia in 1876, and many years later he received a medal for the same instrument at the World's Fair in Chicago in 1893.

Another machine invented at this time was the meteorograph, a machine of simpler construction, which registered hourly the barometer and wet-and-dry-bulb thermometers. Several of the two machines mentioned above were constructed for the United States government.

He also invented an automatic anemometer, which records the velocity of the wind in the form of a curve, prints the results hourly in miles, and also gives the direction, electricity being used as the active agent. He published a long series of observations made with this machine, and was one of the first to point out the intimate connection between atmospheric pressure and the direction of the wind.

Besides these instruments, he invented the first horizontally-driven machine-saw, and also began work on his printing chronograph. He was an expert mechanic, and did all the work on his machines with his own hands.

In 1868 he made a long series of investigations on the Daniel or gravity battery, and was the first to show that lead may be advantageously substituted for copper as the negative plate. He also showed that the substitution of a cell of leather 0.06 inch thick in place of the porous clay cell in the battery produced double the amount of current. Moreover, that the quantity of electricity

flowing in the external circuit depends on the specific gravity of the zinc sulphate, and that polarization in the battery is caused by the saturation of the zinc sulphate.

He made important investigations concerning the velocity of the electric current, and showed that the apparent velocity is directly proportional to the magnetic force of the circuit, but the real velocity can not be measured.

In 1869 he was chief of an expedition of astronomers sent to Matoon, Ill., to observe the total eclipse of the sun.

In 1870 he was married to Emma C. Shear, daughter of Jacob H. Shear, of Albany, N. Y.

He was elected an honorary member of the German Astronomical Society in 1871. Almost from the beginning of his professional career he took an active part in the meetings of the American Association for the Advancement of Science, and was at one time vice-president.

In the year 1879 he was appointed director of the Dearborn Observatory at Chicago and professor of astronomy in the old Chicago University. His work at once brought Dearborn Observatory into special prominence among the leading observatories of the world.

It was then that he began his systematic study of the planet Jupiter, and this series of observations was continued without interruption for thirty years till the time of his death. These observations included a careful study by micrometer measurements of all the jovian phenomena, especially of the great red spot and the equatorial belts, and made Professor Hough justly famous in the latter days of his life as the greatest authority for that planet. The details and results of these investigations are to be found in the various annual reports of the Chicago Astronomical Society, and in numerous pamphlets published after he came to Evanston.

He also made observations of the satellites of Uranus, and discovered a few new nebulæ. During the first few years in Chicago he was associated in his work with Professor Colbert and Professor Burnham.

In 1882 he took up the study of difficult double stars, and is credited with having discovered over 600 pairs, most of them beyond the reach of any but the most powerful telescopes, which gave him the distinction of having discovered more double stars than any other astronomer of his time.

While in Chicago he perfected his printing chronograph, an instrument which is coming into general use in observatories. He also invented an observing seat for the equatorial, which has been adopted by all the leading observatories.

He became interested in the Chicago Academy of Sciences, and served one term as vice-president of that institution.

In 1887 the Dearborn Observatory was moved to Evanston and became part of the Northwestern University. Professor Hough came with it as director, and as professor of astronomy in Northwestern University. During his twenty-one years' residence in Evanston he accomplished a large part of his important work on Jupiter and double stars.

In 1888 he invented a new astronomical dome, superior to anything else of the kind. His inventions here include an absolute sensitometer for testing photographic plates in various kinds of light, an electrical control for the equatorial, an improved form of storage battery combining durability and low cost, a transmission dynamometer for use with the electric motor, and a new and improved form of photographic plate-holder.

In 1891 he received the honorary degree of doctor of laws from Union College, and about the same time was elected a member of the British Astronomical Association. At the World's Congress in Chicago in 1893 he was president of the mathematical and astronomical section. In 1903 he was elected an associate member of the Royal Astronomical Society of England. He was also a member of the Astronomical Society of the Pacific, the Astronomical and Astrophysical Society, the American Philosophical Society, the American Institute of Civics, the Chicago Photographic Society and the Trinity Historical Society of Texas, and at one time a member of the Albany Institute, the Chicago Lantern Slide Club and the Chicago Electrical Society.

In character Professor Hough was quiet

and unassuming, but of an affectionate, genial disposition, and was greatly beloved by all who knew him. His learning and knowledge were vast, and very wide in their scope. He never spoke hastily nor too much, and his opinion on a subject was always worth having. In my long association with him I have often felt the truth of Emerson's words: "Converse with a mind that is grandly simple, and literature looks like word catching."

The sudden death of this great and good man came as an irreparable loss not only to the community but to the whole scientific world.

George J. Hough

DINNER TO PROFESSOR RAMSAY WRIGHT

The old pupils and colleagues of Professor Ramsay Wright, of the University of Toronto, joined in celebrating the completion of his thirty-fifth year of service in the university by tendering him a complimentary banquet and address on April 15. The chair was taken by Professor J. Playfair McMurrich, the toast to the university was proposed by Professor F. R. Lillie, of the University of Chicago, that to the guest of the evening by Dr. T. MacCrae, of the Johns Hopkins University, and the address was presented by Professor A. B. Macallum. A number of letters from distinguished colleagues of other universities were read, all of which bore ample testimony to the value of the services rendered by Professor Wright in the development of the biological sciences in Canada, in the elevation of the standards of medical education and in the constant maintenance, both by example and precept, of the highest ideals of scholarly attainments. A pleasing incident of the banquet was the reading of a Latin ode composed for the occasion by Professor Maurice Hutton, and of a sonnet by Professor W. H. Ellis, which follows:

From Scotland's mists across the sea you bore
The sacred fire (kindled by him whose name
Has made the century famous with his fame),
And bid our lamp burn brighter than before.
Upon our tree, a branch from Scotland's shore
You grafted, and behold, our tree became
Wanton in leafage; with blossoms all aflame;
Deep rooted; and with boughs to heaven that soar.
We see the better issue from the strife,
And hope the best. In loathsome crawling things
We feel the fluttering of jeweled wings.
In nature's score, with seeming discords rife,
We seek to read, with you, the note that brings
To harmony the jarring chords of life.

THE SHAW SCHOOL OF BOTANY

The recently issued administrative report of the Missouri Botanical Garden, and an announcement of Washington University concerning the Henry Shaw School of Botany, indicate that the Shaw foundation is on the eve of entering upon a much increased activity. Although Henry Shaw in 1885 endowed a school of botany in Washington University, to the head of which Professor Trelease was called from the University of Wisconsin, the provision made was practically for only a chair of botany. Four years later, on the death of Mr. Shaw, his fortune, appraised at several million dollars, passed to the care of trustees, for the maintenance of his long established and well known garden and the further development of an institution of research and instruction in botany and allied sciences; the head of the School of Botany being selected as its director.

In the twenty years that have since passed, the trustees of the Shaw estate have been compelled to administer their trust on a maintenance basis, seeing approximately a quarter of their gross income absorbed in general taxes and nearly as much more claimed for street improvements, sewers and similar purposes, a large part of which were entailed by the possession of extensive tracts of unimproved real estate within the city limits. Meantime, the revenue of the School of Botany has sufficed for scarcely more than meeting the undergraduate needs of the university. Nevertheless, maintenance of the garden has been made to include the provision of a good equipment in living plants (11,464 forms), herbarium (618,872 specimens) and library (58,538 books and pamphlets). A part of the time of otherwise indispensable employees has been given to botanical investigation, the results of which are published in a series of annual reports begun in 1890,

and fifteen graduate degrees have been earned in the School of Botany.

Though a continuation of high special taxes is anticipated for the next few years, the trustees of the garden hope to see the end of this burden before a great while, and in cooperation with the university authorities they are now prepared to make larger research use of the equipment on hand and begin to provide for graduate instruction to a greater extent than has been possible heretofore. Last year a well designed fireproof building of about 12,000 square feet of floor space was put up. A part of this is being furnished in steel for stack purposes, and the remaining—and larger—part is being equipped for laboratory use. It is now announced that a definite step toward the fuller development contemplated by the founder and planned by the director has been taken in the establishment of the post of plant physiologist at the garden, and the creation of a professorship of plant physiology and applied botany in the Shaw School of Botany, with provision for two research fellowships in botany: in addition to the Englemann professorship held by Dr. Trelease, the assistant professorship held by Dr. Coulter, a teaching fellowship to which Mr. C. D. Learn has recently been appointed, and the honorary post of plant pathologist at the garden held by Dr. von Schrenk.

With this equipment and staff, which are to be gradually increased and are likely to be much enlarged in the near future, it is intended to develop research and graduate instruction and to establish in the broadest sense a course in applied botany, in addition to giving the undergraduate instruction needed in Washington University.

To the new professorship, Dr. George T. Moore has been called, as possessing to an unusual extent the desired combination of established reputation, breadth of view and expert appreciation of the economic applications of botany. The research fellowships are open to capable graduate students from any college, and are believed to offer unusual opportunities for the productive use of talent in investigation. The library, herbarium and garden furnish the necessary facilities for the most advanced investigation, and the work in the School of Botany is to be so planned that the individual needs of students engaging in research will be met in every way possible, while leading to the customary degrees.

SCIENTIFIC NOTES AND NEWS

THE following new members of the National Academy of Sciences were elected at the meeting on April 22, 1909: Professor Joseph S. Ames, Johns Hopkins University; Professor Maxime Bôcher, Harvard University; Professor Oskar Bolza, University of Chicago; Mr. Frank W. Clarke, U. S. Geological Survey; Dr. John M. Clarke, New York State Museum; Professor John M. Coulter, University of Chicago; Professor Henry Crew, Northwestern University; Professor Thomas Hunt Morgan, Columbia University; Mr. Waldemar Lindgren, U. S. Geological Survey; Professor Henry L. Wheeler, Yale University. The following were elected foreign associates: Professor Albrecht Penck, University of Berlin; Professor Gustaf Retzius, Stockholm; Professor Wilhelm Waldeyer, University of Berlin; Professor Wilhelm Wundt, University of Leipzig.

DR. ARRIGO TAMMASSIA, professor of forensic medicine in the University of Padua, has been created by the king of Italy a senator of the kingdom.

PROFESSOR G. LUNGE, of Zurich, has been elected an honorary member of the London Chemical Society.

THE founder's medal of the Royal Geographical Society has been awarded to Dr. Stein for his archeological and geographical explorations in Central Asia. The patron's medal has been awarded to Colonel Talbot for his surveys on the northwest frontier of India and in the Anglo-Egyptian Sudan.

ST. ANDREWS UNIVERSITY has conferred its doctorate of laws on Dr. James Wallace, F.R.S., professor of chemistry in University of Edinburgh.

DR. GEORGE LINCOLN GOODALE, professor of botany at Harvard University since 1878, will retire from active service at the close of the present academic year. Professor Goodale

will celebrate his seventieth birthday on August 3.

Dr. F. Zirkel, professor of mineralogy at Leipzig, has retired from active service.

Dr. William W. Cadbury has resigned as pathologist in the Henry Phipps Institute, Philadelphia, and sailed for China, where he will aid in the establishment of a University Medical School in Canton.

Mr. D. L. Van Dine, who has been the entomologist of the Hawaii Agricultural Experiment Station for the past seven years, has accepted a position in the Bureau of Entomology at Washington. His work will be on the insects affecting sugar cane and rice in the southern states.

At the meeting of the Board of Directors of the Rockefeller Institute for Medical Research, held on April 10, the following promotions and appointments were made:

Associate Members—John Auer (Physiology), Hideyo Noguchi (Pathology), Alexis Carrel (Surgery).

Associate—George W. Heimrod (Chemistry).

Assistants—Martha Wollstein (Pathology), Richard V. Lamar (Pathology), A. O. Shaklee (Physiology), Gustave M. Meyer (Chemistry).

Fellows—M. T. Burrows (Pathology), Paul F. Clark (Bacteriology).

Professor H. G. van de Sande Bakhuyzen has retired from the directorship of the Leyden Observatory and is succeeded by Mr. E. F. van de Sande Bakhuyzen.

Dr. Max Wolf has been appointed director of the University at Heidelberg in succession to Dr. Wilhelm Valentiner, who has retired owing to ill health.

Dr. Ernst Küster, of Halle, has been appointed keeper in the Botanical Institute and Garden at Kiel.

Dr. S. Squire Sprigge has accepted the editorship of the *Lancet*.

The State Department has approved the attendance of the following as American delegates at the International Congress of Applied Chemistry to be held in London next month: Dr. Harvey W. Wiley, chief of the Bureau of Chemistry of the Department of Agriculture; Dr. Allerton S. Cushman, of the same department; Dr. Frank Wigglesworth Clarke, of the U. S. Geological Survey; Dr. Charles Baskerville, professor of chemistry at the City of New York College; Drs. William H. Nichols, Maximilian Toch, Herbert Plaut and Morris Loeb, of New York; Dr. William L. Dudley, of Vanderbilt University, and Dr. L. H. Baekeland, of Yonkers, N. Y.

Dr. Raymond L. Ditmars, curator of reptiles in the New York Zoological Park, sailed for Europe on May 8 to visit the Zoological Gardens and arrange for the exchange of animals.

Professor F. L. Stevens, of the North Carolina Station and College, will during this vacation visit the leading agricultural experiment stations and agricultural colleges of Europe, particularly those experiment stations engaged in work in plant disease or soil bacteriology.

Professor William Osler, of Oxford, is paying a visit to the United States and Canada. He expects to return to England on July 1.

Dr. Stelberg, accompanied by Dr. de Quervain and Dr. Balber, has been sent by the Danish government on a scientific expedition to Greenland.

Dr. Skottsberg, the Swedish explorer, has returned from an expedition to southern Patagonia.

Mr. Douglas Carruthers has returned from a natural history exploration in the unknown parts of central Arabia.

It is announced in the English journals that Dr. W. Bruce, of the Scottish Oceanographical Laboratory, has made more detailed plans of another Antarctic expedition to leave in 1911, the cost of which is estimated at £50,000. It is proposed to carry on extensive oceanographical work in the South Atlantic Ocean between and south of Buenos Ayres and Cape Town, as well as in the Weddell and Biscoe Seas; to map the coast-line of Antarctica to the east and west of Coats Land, and to investigate the interior of Antarctica in that longitude. Part of the project includes a journey across the Antarctic continent, starting at some suitable base in the

vicinity of Coats Land and emerging at McMurdo Bay, Victoria Land or King Edward Land. The program includes a circumpolar bathymetrical survey, especially in relation to the study of former continental connections. Mr. C. E. Borchgrevink will also conduct a new expedition to South Polar regions. The expedition, the financial and other details of which have already been settled, has been arranged under the auspices of the International Polar Exploration Commission at Brussels.

A party sent by the government to investigate the circumstances connected with the murder by Ilongote tribesmen of Dr. William Jones, of the Field Museum of Natural History, Chicago, has recovered the valuable collection made during the past two years.

At the 665th meeting of the Philosophical Society of Washington, held on April 26, Professor Max Planck, of Berlin, gave a lecture entitled "Die Mechanik als Grundlage der Physik," complimentary to the American Physical Society.

Mr. J. G. Jack will conduct a Field Class at the Arnold Arboretum, Harvard University, on Saturdays during the spring and early summer, to assist those who wish to gain a more intimate knowledge of the native and foreign trees and shrubs which grow in New England.

Professor Baskerville announces a course of lectures by eight or ten recognized experts in the City of New York upon such subjects as water supply, sewage, gas, storage of combustibles, food adulteration, etc.

The Sioux City Academy of Sciences held its annual meeting on April 13. Its program was devoted to a Darwin memorial which was as follows:

"The Biography of Charles Darwin," Professor H. C. Powers.

"Charles Darwin and the Theory of Natural Selection," Rev. Manley B. Townsend.

"The Principle of Natural Selection as Applied in Education," Professor E. A. Brown.

"A Philosophy Out of Darwin," Rev. Ralph P. Smith.

Professor F. W. Mott, F.R.S., began on April 20 a course of two lectures at the Royal Institution on "The Brain in Relation to Right-handedness and Speech." On April 24 Mr. R. T. Günther began a course of two lectures on "The Earth Movements of the Italian Coast, and their Effects." The Friday evening discourse on April 23 was delivered by Mr. Alexander Siemens on "Tantalum and its Industrial Applications."

Henry August Hunicke, formerly professor of chemistry in Washington University, and later chemist for the Anheuser-Busch Brewing Association and a practising chemical engineer, died at St. Louis on April 5 at the age of forty-eight years.

Albert B. Porter, for ten years professor of physics at the Armour Institute, Chicago, and later engaged in the manufacture of scientific instruments, died on April 17, at the age of forty-three years.

Mr. Frederick Kato, who was interested in mineralogy, died of pneumonia in his home on Jersey City Heights on April 20, at the age of forty-three years.

Dr. Fritz Roemer, director of the Senckenberg Museum of Natural History at Frankfort, has died at the age of forty-two years.

At the meeting of the American Philosophical Society in Philadelphia on April 22, Mr. Edwin Swift Balch presented the following resolution which was passed unanimously:

Whereas, The United States in former years made many brilliant discoveries in the Antarctic, including the continent of Antarctica by Charles Wilkes, and

Whereas, The United States have not taken any part in the recent scientific explorations of the South Polar regions;

Resolved, That the American Philosophical Society requests the cooperation of the scientific and geographical societies of the United States, to urge on the United States Navy and the general government, that it do make sufficient appropriations to fit a government vessel to thoroughly explore and survey the coast of Wilkes Land, and other parts of Antarctica.

By recent act of the legislature provision has been made for a biological station to be located on the shores of Devil's Lake, North Dakota. An appropriation has been made for building laboratories and providing annual

maintenance. This laboratory will be fortunately situated for the study of many interesting ecological and physiological problems, inasmuch as Devil's Lake is a large body of brackish water with no outlet and represents the collected water supply of a large interior drainage basin. The direction of this laboratory will be under the charge of the biological department of the State University, of which Professor Melvin A. Brannon is head.

THE fifteenth general meeting of the American Electrochemical Society will be held at Niagara Falls, Canada, on May 6, 7 and 8. The retiring president, Mr. E. G. Acheson, has chosen as the subject of his address "The Electrochemist and the Conservation of Our National Resources." The program includes a symposium on "The Electrometallurgy of Iron and Steel," to include eleven papers.

THE New York Botanical Garden offers the following prizes for essays not exceeding 5,000 words, from the income of the Caroline and Olivia E. Stokes Fund for the Preservation of Native Plants: (1) \$40, (2) \$25, (3) \$15. Essays must be typewritten in duplicate and must reach the garden not later than June 20, 1909.

KING LEOPOLD, of Belgium, has decided to grant a prize of \$5,000 to the author of the best work answering the following question: "Describe the progress of aerial navigation and the best means to encourage it." All essays or works relative to the subject and competing for the prize must be sent to the minister of science and arts in Brussels before March 1, 1911. The competition is open to all nationalities. No new edition of any work already in print will be admitted to this competition unless it comprises thorough changes and considerable additions. In case certain sections of any work or essay on the subject have already been published, such work or essay may still be able to enter in this competition providing the last part is published during the time allotted for the competition. The jury will comprize three Belgians and four foreign members. No member of the jury will be allowed to send any work or essay to the competition. The manuscript, work or essay winning the prize must be published during the year following the one in which the prize will be awarded. Competitors may use French, English, Flemish, German, Italian, Spanish or Portuguese.

THE Hampstead Scientific Society has under consideration a proposal to establish an astronomical observatory and meteorological station on the reservoir near the summit of Hampstead Heath, London. It is proposed to rent, at a nominal charge, a portion of the top of the reservoir near the Whitestone Pond, to build there an observatory house, and to erect the eight-inch reflecting telescope, equatorially mounted, by Grubb, presented to the society some two years ago by Dr. F. Womack; and to establish on the same area a meteorological station, equipped as a "Normal Climatological Station" under the regulations of the Meteorological Office.

ARRANGEMENTS have been made by Professor Foerster, of the University of Berlin, to republish in German an abstract of the documents of the American Association for International Conciliation. Separate articles by Mr. Elihu Root, Mr. Andrew Carnegie, Professor Ladd, of Yale, and Professor Rowe, of the University of Pennsylvania, have been translated into foreign languages, but this is the first arrangement for a general translation and republication.

THE Appalachian Engineering Association will meet in Roanoke, Va., on Saturday, May 8, when the following papers will be read:

"Lead and Zinc Ores in Wythe and Pulaski Counties," by Mr. M. M. Caldwell, of Roanoke.

"Organization and Engineering Difficulties of the Virginian Railway," by Major William N. Page, of Washington, D. C.

"The Virgilina Copper District," by Dr. Thomas L. Watson, State Geologist of Virginia, and Professor of Economic Geology, University of Virginia.

"Geologic Engineering Code of Ethics," by Captain Baird Halberstadt, of Pottsville, Pa.

"Properties and Uses of Mineral Gypsum," by Dr. Frank A. Wilder, of North Holston, Va., ex-State Geologist of Iowa.

The meeting will be followed on Saturday evening by a banquet for the association

and invited guests, tendered by the Chamber of Commerce of Roanoke.

The fourth annual meeting of the Oregon State Academy of Sciences was held at the High School, Salem, on February 19 and 20, with the following program:

President's Annual Address, A. R. Sweetser.

Illustrated Lecture on Birds, Wm. L. Finley.

"Some Perplexing Problems in the Most Complex of the Sciences," Gaylard H. Patterson.

"Disturbance of Embryonic Nutrition," Ernest Barton.

"The Mineral World," W. A. Miller.

"Some Hymenoptera," C. E. Bridwell.

"The Sea Side Laboratory at Friday Harbor" (illustrated), C. O. Chambers.

"The Kinetic Theory of Matter," B. C. Eastham.

"Denatured Alcohol," C. E. Bradley.

"Problems in Sex Determination," J. F. Bovard.

The National Association for the Prevention of Consumption has arranged to hold a tuberculosis exhibition at the Art Gallery, High Street, Whitechapel, London. The exhibition will illustrate the extent, cause, spread, prevention and cure of tuberculosis, and will have a special section devoted to tuberculosis in children. It is expected that the exhibition will be opened by the President of the Local Government Board on June 2, and it is proposed that after it has been shown in London it should be taken to various provincial cities and towns.

UNIVERSITY AND EDUCATIONAL NEWS

A board of education has been established in Iowa to control the State University, the State College of Agriculture and the Mechanic Arts and the State Normal School. The board is to consist of nine members, appointed by the governor, and confirmed by the senate, five to be republicans and four democrats. The members of the board serve for six years, one third retiring every two years. The board is to elect a finance committee, of three members, from without its own membership. These three men are to give their entire time to the business management of the institutions, and are to receive salaries of $3,500 a year.

The twelfth conference for education in the south was held in Atlanta, Ga., April 14 to 17. The conference, while discussing general educational subjects, was devoted especially to the improvement of conditions in the open country. The president, Mr. Robert C. Ogden, of New York, gave an address, and the program included addresses on "The American Spirit in Education," by Dr. S. C. Mitchell, the newly elected president of the University of South Carolina; "The National Program in Education," by Dr. Elmer Ellsworth Brown, U. S. Commissioner of Education; "How the National Government may cooperate with the States in Bettering Conditions in the Open Country," by Mr. Gifford Pinchot, of the Forest Service, Washington.

Dr. W. F. Dearborn, assistant professor of educational psychology in the University of Wisconsin, has resigned to take a similar position in the University of Chicago. Dr. B. H. Bode, assistant professor of philosophy in the University of Wisconsin, has resigned to accept a professorship in the University of Illinois.

Dr. Edmund Landau, of Berlin, has been called to a professorship of mathematics at Göttingen.

Dr. Herman Kobold has been called from Kiel, to a professorship of astronomy at Berlin.

M. Paul Langevin has been appointed professor of physics in the Collège de France, as successor of the late M. Mascart.

DISCUSSION AND CORRESPONDENCE

ON GENERIC NAMES

In a recent issue of Science, Dr. Hubert Lyman Clark has done good service in deprecating the too familiar practise of naming species after (commonly insignificant) persons. While not a systematic zoologist *sensu stricto* myself, I have had occasion to consult taxonomic works quite extensively for a number of years past, and I am therefore in a position to appreciate the force of Dr. Clark's criticisms. It is my object here to extend their application a little, so as to cover generic names as well. It appears to me that for these last the objection holds with even greater force, since the genus is, theoretically, at

least,[1] a larger category than the species. It is true that we have high precedent for naming genera after persons, as witness the genus *Linnæa*, named for the great master himself by one of his contemporaries. And we have become so accustomed to *Fuchsia* and *Wistaria* that we scarcely ever give thought to their derivation. But what shall we say of *Montagua, Grantia, Perkinsia, Fitzroya, Kellia, Mitchillina, Smithia, Jonesia*, etc.? These were all, no doubt, estimable gentlemen who did their share of the world's work; but are their names commanding enough (to say nothing of euphony!) to deserve perpetuation in scientific literature? And if we should take into consideration the question of euphony, what would become of such genera as *Billingsella, Girardinichthys, Pilsbryoconcha* and *Tarletonbeania*,[2] or of *Kohlera* and *Dyaria*?[3] Any systematist could add indefinitely to this list.

Loyalty to one's friends is a commendable trait, even in a man of science; and a sense of humor is possibly the only thing that saves most of us from suicide or insanity. But there is a time and place for all things. One assumes a grave responsibility in inflicting upon future generations[4] such philological abortions as those to which I have been alluding.

FRANCIS B. SUMNER

WOODS HOLE, MASS.,
March 31, 1909

A MENDELIAN VIEW OF SEX-HEREDITY; A CORRECTION

TO THE EDITOR OF SCIENCE: My attention has been called to the fact that in a recent article on sex-heredity published in SCIENCE, March 5, 1909, I carelessly wrote *lugens* for *lacticolor*, on pages 399 and 400, when referring to the pale variety of *Abraxas grossulariata*.

W. E. CASTLE

March 31, 1909

[1] This qualification is inserted in view of the growing custom of creating a separate genus to contain each species.

[2] This should have been *Tarleton-H-Beania*. Dr. Bean is plainly entitled to damages.

[3] This last I have on hearsay, but it is far from incredible.

[4] This is confessedly a bit of rhetorical exaggeration. A taxonomic name does not generally endure over five years, if, indeed, it is fortunate enough to be overlooked for so long a period.

BIOGRAPHICAL DIRECTORY OF AMERICAN MEN OF SCIENCE

THE undersigned will print as soon as the compilation can be made, a second edition of the *Biographical Directory of American Men of Science*. The work is intended to be a contribution to the organization of science in America, and the editor will greatly appreciate the assistance of scientific men in making its contents accurate and complete. Those whose biographies appear in the first edition are requested to forward such alterations and additions as may be necessary or desirable, and to obtain biographical sketches from those who should be included. All those engaged in scientific work whose biographies are not included in the first edition are requested to send the information needed, using for this purpose the blank that is given on an advertising page (vii) of the current issue of SCIENCE.

It is intended that each entry shall contain information as follows:

1. The full name with title and mail address, the part of the name ordinarily omitted in correspondence being in parentheses.
2. The department of investigation given in italics.
3. The place and date of birth.
4. Education and degrees, including honorary degrees.
5. Positions with dates, the present position being given in italics.
6. Temporary and minor positions; scientific awards and honors.
7. Membership in scientific and learned societies with offices held.
8. Chief subjects of research, those accomplished being separated by a dash from those in progress.

All those in North America should be included in the book who have made contributions to the natural and exact sciences. The standards are expected to be about the same as those of fellowship in the American Association for the Advancement of Science or

membership in the national scientific societies which require research work as a qualification.

The compilation of the new edition will of necessity involve much labor, but this will be materially lightened if men of science will reply promptly to this request.

J. McKeen Cattell

Garrison-on-Hudson, N. Y.

SCIENTIFIC BOOKS

The Biota of the San Bernardino Mountains. By Joseph Grinnell. University of California, Publications in Zoology, Vol. V., No. 1. Pp. 170, plates 24. December 31, 1908.

As a contribution to the zoology and botany of southern California, Mr. Grinnell has given us a paper based on three summers' field work in the San Bernardino Mountains. Its principal sections are: "Life Zones of the Region," with lists of characteristic species of plants of each zone; "Descriptions of Localities," with special reference to their zonal positions; "General Considerations relating to Bird Population; a List of the Important Plants," largely trees and shrubs, with notes on their distribution; "A List of 139 Species of Birds," with detailed notes on distribution, breeding, food and other habits; "A List of 35 Species of Mammals," with notes on distribution, abundance and habits; and "A List of 20 Reptiles," lizards, horned toads and snakes, with notes on range and habits.

It is a great satisfaction to find a fellow worker in the field of geographic distribution who, instead of discovering at once new laws and naming new distribution areas, accepts and follows with conscientious care the general principles of distribution governing the transcontinental life zones and their subdivisions, as worked out by the U. S. Biological Survey. Even the color scheme of the biological survey zone map is followed, with one exception, which is possibly accidental or the fault of the lithographer. This exception consists in using red, which is usually applied to Tropical zone, for Lower Sonoran, which should have been orange. The colors of the higher zones, yellow for Upper Sonoran, blue for Transition, and green for Boreal, are standards so long in use as to have become familiar to many. Uniformity in such details is helpful to all who use zone maps.

In reviewing a work of such general excellence, and with so few faults, it seems ungracious to attack the first word in the title, but to many of us, either of the long familiar expressions *fauna and flora,* or *plants and animals,* or for brevity just *life,* would have sounded as well and meant as much as *biota.* However, as this term has been used before, the author escapes the graver criticism of introducing an unnecessary Greek substitute for a good English expression.

The use of the name tamarack, or tamarack pine, for the lodge pole or Murray pine (*Pinus murrayana*), while often used locally where there are no tamaracks, grates on the nerves of those brought up among the real tamaracks (*Larix*), as well as those to whom the name lodge-pole pine recalls camps on the borders of beautiful mountain meadows or the sharp cones of slender tepee poles in the camps of Cheyenne, Arrapahoe, Blackfeet, Crow and Sioux. It may not be possible to correct local misuse of names, but why extend it?

An evident error in the zone map consists in extending Transition zone to the upper limit of *Pinus jeffreyi* instead of confining it to the limits of *Pinus ponderosa, Pinus lambertiana, Libocedrus decurrens, Quercus californica* and the accompanying set of plants and animals. As a result the zone is extended in places at least five hundred feet too high, and the Canadian zone above is correspondingly narrowed. This has apparently resulted from a failure to clearly discriminate between *Pinus ponderosa* and *jeffreyi* and therefore to crediting them with the same range (p. 31). *Pinus jeffreyi* in the San Bernardino, San Jacinto and Sierra Nevada Mountains ranges generally 500 to 1,000 feet higher than *ponderosa,* and by just this much overlaps the lower edge of Canadian

zone.[1] While leading to some confusion in the resulting effort to separate Transition zone into upper and lower divisions, this error is largely compensated by the fact that the vertical range of each species is given and the zones can be checked up thereby. When the zone-marking species are accurately mapped over wider areas, such local defects are easily eliminated.

Approximately ninety pages are devoted to notes on the 139 species of birds, and it is only fair to say that few lists of equal length have contained so much important data on distribution, abundance, migration and habits. A chapter on Bird Population and its Modifying Influences throws much light on local migrations up and down the mountains in pursuit of food, while the bird census and the varying abundance of birds in relation to insect food show the vital importance of birds in an agricultural region. The great number of nesting records, each with date, exact locality, altitude and zonal surroundings, gives for the first time sufficient data for mapping the breeding zones of many of the species in these mountains and furnishes a mine of material for the student of distribution. The nesting habits, food habits, songs, call notes, rare eggs and rare or little known plumages are described and much information that is actually new is put on record.

The notes on 35 species of mammals cover twenty-six pages and are practically all first-hand records of observations on distribution, abundance, food and habits. Many of the species that show local variation or interesting peculiarities are described in detail and in some cases tables of measurements are given. All of these notes are of permanent value and contribute toward a fuller knowledge of our native mammals.

Eleven pages of notes on lizards and snakes are of importance in defense of these interesting, useful and much maligned animals.

Besides the colored zone map and transverse section of the mountain zones there are twenty-two full-page plates from photographs of mountain scenery, trees, shrubs, birds' nests and snakes.

The value of such detailed, accurate and reliable local surveys is appreciated nowhere more than in the U. S. Biological Survey, which is working along the same lines over wider fields.

VERNON BAILEY

[1] The same error of extending transition zone to the upper limit of *Pinus jeffreyi* was made by Dr. H. M. Hall in his otherwise accurate and excellent botanical survey of the San Jacinto Mountains, and in this case also it led to an effort to separate the zone into upper and lower divisions. (See University of California Publications in Botany, Vol. I., pp. 1–140, 1902.)

The Microscope; an Introduction to Microscopic Methods and Histology. By SIMON HENRY GAGE, Professor of Histology and Embryology, Emeritus in Cornell University. Tenth edition. Pp. 359, 258 figures.

The tenth edition of this well-known book on the microscope retains all the meritorious features which have contributed to the success of the former editions. It has been the author's constant desire to have his book represent the "present state of knowledge of the microscope and the technique of its employment." All who have had acquaintance with the former editions (and who among microscopists has not?) know how successful he has been in accomplishing this end. In the present edition, besides incorporating discussions of new or improved features of the microscope and its accessories, additions have been made to the sections dealing with the manipulation of materials.

The same general order of presentation has been followed as in former editions. Of the ten chapters which constitute the work, chapters I.–VII., deal with the microscope and its appliances. Chapter VIII. is given up to various methods of photography (including photographing with a microscope, photographing opaque objects and the surface of metals and alloys, enlargements, etc.) and is rich in practical directions and advice, serviceable to the experienced, as well as to the inexperienced, worker. Chapter IX. is devoted to the preparation of reagents, the making of microscopic mounts, together with notes and comments on materials, methods of storing, and

the like, and is interspersed with numerous useful hints and cautions. In the 48 pages of chapter X., the author gives a concise statement of the fixation, sectioning, staining and mounting of tissues, together with brief discussions of microtomes and section knives, drawings for book illustrations, and the preparation of models. The practicability of the method for making models of blotting paper will appeal to all biological workers.

The book is remarkably free from typographical errors. Only two or three insignificant ones have been noted by the reviewer, as: the omission of the prime marks of *A'B'*, Fig. 15, page 6; *ecently* for *recently,* page 260; and *speimen* for *specimen,* page 282.

An extended review of the book would be superfluous as its merits are already sufficiently known to the readers of SCIENCE. Its past success is adequate commentary on the author's judgment as to what is needful in a book devoted to the principles involved in making microscopic observations.

MICHAEL F. GUYER

SCIENTIFIC JOURNALS AND ARTICLES

THE April number (volume 10, number 2) of the *Transactions of the American Mathematical Society* contains the following papers:

L. E. Dickson: "General theory of modular invariants."

I. Schur: "Beiträge zur Theorie der Gruppen linearer homogener Substitutionen."

E. J. Wilczynski: "Projective differential geometry of curved surfaces (fourth memoir)."

Edward Kasner: "Natural families of trajectories: conservative fields of force."

G. W. Hartwell: "Plane fields of force whose trajectories are invariant under a projective group."

W. A. Manning: "On the order of primitive groups."

G. D. Birkhoff: "Existence and oscillation theorem for a certain boundary value problem."

Maxime Bôcher: "On the regions of convergence of power series which represent two-dimensional harmonic functions."

THE April number (volume 15, number 7) of the *Bulletin of the American Mathematical Society* contains: Report of the February meeting of the society, by F. N. Cole; "Bézout's Theory of Resultants and its Influence on Geometry" (presidential address), by H. S. White; "On the Representation of Numbers by Modular Forms," by L. E. Dickson; "Note on Lüroth's Type of Plane Quartic Curves," by H. S. White and K. G. Miller; "Cantor's History of Mathematics," by D. E. Smith; "Shorter Notices": Slaught and Lennes' High School Algebra, by E. B. Lytle; Schoenflies' Einführung in die Hauptgesetze der zeichnerischen Darstellungsmethoden, by Virgil Snyder; Laurent's Géométrie Analytique Générale, by E. B. Cowley; Petit-Bois' Tafeln unbestimmter Integrale, by E. L. Dodd; Annuaire du Bureau des Longitudes, by E. W. Brown; "Notes"; "New Publications."

THE May number of the *Bulletin* contains: Report of the February meeting of the San Francisco Section, by W. A. Manning; "The Construction of a Space Field of Extremals," by E. G. Bill; "The Second Variation of a Definite Integral," by A. L. Underhill; "A Simpler Proof of Lie's Theorem for Ordinary Differential Equations," by L. D. Ames; "Heath's Euclid," by D. E. Smith; "Shorter Notices": Czuber's Differential- und Integralrechnung, by L. W. Dowling; Fabry's Traité de Mathématiques Générales, by C. L. E. Moore; Schubert's Auslese aus meiner Unterrichts- und Vorlesungspraxis and Loria's Passato ed Presente delle Teorie Geometriche, by Edward Kasner; Müller's Führer durch die mathematische Literatur, by G. A. Miller; Voss' Ueber das Wesen der Mathematik, by Florian Cajori; "Notes"; "New Publications."

BOTANICAL NOTES

THE BOTANY OF THE FAERÖES

EIGHT years ago under the general direction of Professor Dr. Eugene Warming the first volume of a comprehensive work on the vegetation of the Faeröes Islands was published simultaneously in Copenhagen (Det Nordiske Forlag) and London (John Wheldon & Co.). It contained 340 pages of text, ten plates and

fifty illustrations in the text. There is first a short historical chapter by Warwing on the earlier botanical investigations of the islands, followed by a chapter of about thirty pages by C. H. Ostenfeld on the geography, geology, climate, etc., in which we learn that there are about twenty islands, of all sizes, from mere islets to the larger islands thirty or more kilometers long and ten to twelve in width. They lie about 7° west of the meridian of Greenwich, and in latitude 62° north of the equator, and are nearly midway between Scotland and Iceland. In general they are mountainous, the elevations reaching to between eight and nine hundred meters. The air is moist and cool, and there is much rainfall (159.3 centimeters—nearly 64 inches).

Following these general chapters are those devoted to Phanerogamae (261 species) and Pteridophyta (24 species), by C. H. Ostenfeld; Bryophyta (338 species), by C. Jensen; Freshwater Algae (323 species), by E. Borgesen; Freshwater Diatoms (248 species), by E. Ostrup; Fungi (168 species), by E. Rostrup, and Lichens (194 species), by J. S. D. Branth.

The second volume, which appeared in 1903, includes papers on marine Algae (216 species), by F. Borgesen; Marine Diatoms (182 species), by E. Ostrup; Phytoplankton from the Sea (93 species), by C. N. Ostenfeld; Phytoplankton from the Lakes (17 species), by F. Borgesen and C. H. Ostenfeld; the Hieracia of the Faeröes (21 species), by H. Dahlstedt, and concludes with a History of the Flora of the Faeröes, by Professor Warming in his peculiarly lucid and interesting style. In summing up his conclusions he says he is fully convinced "that the whole flora—at least all the more highly organized land plants—have immigrated after the glacial period, across the sea, and from the nearest countries, lying east, especially Great Britain."

The third volume, which closes the series, contains more general papers, the first by F. Borgesen being a most interesting ecological study of the marine algae, while those that follow include "additions and corrections" to previous lists of plants, popular plant names, land vegetation, gardening and tree planting, agriculture, etc. A ten-page paper by Professor Warming—"Field-notes on the Biology of Some of the Flowers of the Faeröes"—is full of suggestive observations. In an appendix of twenty-eight pages F. Borgesen and H. Jonsson present a paper on the Distributions of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic for the purpose of comparing the Faeröese Algae with that of other portions of the neighboring seas.

Throughout the work the reproductions of photographs, especially of marine algae, are most excellent and some are really quite remarkable.

THE GRASSES OF CUBA

In a recent "Contribution" from the United States National Herbarium (Vol. XII., part 6) Professor A. S. Hitchcock publishes a "Catalogue of the Grasses of Cuba" which is "based primarily upon the collections at the Estación Central Agronómica de Cuba." Here are deposited C. F. Baker's collections, and the Sauvalle Herbarium. In addition to these Professor Hitchcock has had for study many Cuban collections in the National Herbarium, the collections by Charles Wright (in the Gray Herbarium), and those in the herbarium of the New York Botanical Garden. As a result of his careful studies he is able to enumerate more than two hundred species (228), while Grisebach included 154 and Sauvalle 170.

In the catalogue, in which the only descriptions are to be found in the analytical keys, ten tribes are represented and these include sixty-six genera. The northern botanist misses the *Aveneae, Hordeae* and *Phalarideae,* which appear to have no Cuban representatives. More than three fourths of the species are found in the genera of the series Panicaceae, and considerably more than one half (135) are in the tribe Paniceae. The largest genus (*Panicum*) contains more than a fifth of all the species. Of Bambuseae there are seven species, all of the genus *Arthrostylidium.*

As evidence of the commendable conservatism of the author may be cited the fact that he has found it necessary to found but one

new genus (*Reimarochloa*), nine new species, and to change the names (new combinations) in but nineteen cases.

CHARLES E. BESSEY
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SPECIAL ARTICLES

SECONDARY CHROMOSOME-COUPLINGS AND THE SEXUAL RELATIONS IN ABRAXAS

IN Professor Castle's interesting communication on sex-heredity, published in the issue of SCIENCE for March 5, a view is advanced that is akin to the "provisional formulation" that I recently offered,[1] but seems to me a decided improvement upon it. In the course of his discussion Professor Castle points out that the "XX and X" formula, which holds true for so many insects, apparently can not be applied to the conditions in *Abraxas,* as indicated by the experimental results of Doncaster and Raynor. These results only seem explicable under the view that the relation with which we have become familiar in other insects is here reversed, the female being heterozygous and the male homozygous in respect to sex (Bateson, Doncaster); and with this conclusion I concur. Definite cytological evidence has now been produced that the same is true of some other animals. The work of Baltzer, done in Boveri's laboratory[2] shows that in the sea-urchin all the sperm-nuclei are alike, while the egg-nuclei are of two classes, approximately equal in number. All of the gamete-nuclei contain 18 chromosomes. In all of the sperm-nuclei and in one class of egg 17 of these are rod-shaped in the metaphase and anaphases of cleavage, and have a terminal attachment to the spindle, while one is a long chromosome that has a subterminal attachment and therefore is hook-shaped. In the other class of egg one of the rods is replaced by a second somewhat shorter hook-shaped chromosome. The latter, therefore, forms a distinctive differential between the sexes; and cytologically considered the female is heterozygous, the male homozygous. A cytological parallel to the condition inferred from the experimental data in the case of *Abraxas* is thus demonstrated. Furthermore, if the differential chromosome in the sea-urchin is of the same general nature as the X-element of the insects, a confirmation is given of Castle's assumption that in one class of cases (*e. g.,* Hemiptera) XX means the female condition and X the male, while in another class of cases the presence of X means the female, its absence the male.

From the point of view thus given the importance of a cytological study of *Abraxas* is manifest. Thanks to the courtesy of Mr. Doncaster, I have for some time had this material under investigation; but unfortunately it presents great practical difficulties. So much may, however, be said, that while the spermatogonal divisions present a normal appearance, the spermatocyte divisions, in both the hybrid and the pure forms, show remarkably complicated and puzzling phenomena that are unlike anything hitherto described in other insects. A detailed analysis of the distribution of the chromosomes in maturation will, I fear, prove impracticable, and as far as this particular case is concerned we are for the present reduced to mere speculative guess-work. I think, however, that we should not hesitate to guess if indications for direct observation can thus be found.

Professor Castle's assumption is that the "repulsion" between the *grossulariata* factor ("G") and the female-producing factor ("X"), postulated by Bateson, "is doubtless due to the fact that the *grossulariata* character acts as the synaptic mate to the X-element." This is, perhaps, admissible; but from the standpoint of the chromosome-hypothesis it involves the following difficulty. In the heterozygous female (GLX in Castle's formula) G is assumed to couple in synapsis, not with its own homologue or allelomorph, L (as it must do in the male GL or GG), but with a different element, X. The L factor is thus left with no synaptic mate; and this result, when followed out, is found to involve still further difficulties. Even though L be regarded as merely the absence of G, this probably does not mean the absence of an entire

[1] SCIENCE, January 8, 1909.

[2] Reported by Baltzer in *Verh. d. deutsch. Zool. Ges.,* 1908, and more recently by Boveri in *Sitzungsber. d. phys.-med. Ges., Würzburg,* 1909.

chromosome, but rather the absence from the G-chromosome of a particular pigment-producing factor. I would therefore regard it as a more plausible guess that a Y-element is present in both sexes, and that both have the same number of chromosomes, the female zygote formula being XY and the male YY, as the facts in the sea-urchin suggest. The female heterozygote thus becomes GLXY, the male GLYY, and the homozygous male GGYY or LLYY. All the facts are then consistently accounted for by the single assumption that G, while acting as the synaptic mate of L, always undergoes also a secondary coupling with Y.

Did such secondary coupling not take place the female GLXY would give rise to the bivalents G/L and Y/X, producing the four classes of gametes GX, GY, LX and LY. If, however, in addition to the primary synaptic coupling of X and Y, G also couples secondarily with Y, the result should be a quadrivalent element, which might have either the tetrad grouping

GY
LX

or the linear grouping

G
Y
X
L

giving in either case the two classes of gametes GY and LX. In the males, GLYY or GGYY, the gametes will of course be GY, LY or GY, GY respectively. This gives a series of formulas identical with those of Bateson and Doncaster, as recast by Castle, if Y be everywhere inserted in its proper place, as follows:

Parents	Constitution	Gametes	Offspring
(1) *Lact.* ♀	LLXY	LX, LY	GLXY = *gross.* ♀
Gross. ♂	GGYY	GY, GY	GLYY = *gross.* ♂
(2) *Het.* ♀	GLXY	GY, LX	GGYY = *gross.* ♂
Het. ♂	GLYY	GY, LY	GLXY = *gross.* ♀
(3) *Lact.* ♀	LLXY	LX, LY	GLXY = *gross.* ♀
Het. ♂	GLYY	GY, LY	GLYY = *gross.* ♂
			LLXY = *lact.* ♀
			LLYY = *lact.* ♂
(4) *Het.* ♀	GLXY	GY, LX	GLYY = *gross.* ♂
Lact. ♂	LLYY	LY, LY	LLXY = *lact.* ♀

This adds nothing in principle to Castle's suggestions, but seems more in accordance with cytological expectation.

Such a mode of coupling may seem very improbable; but I wish to point out that there are at least some approximate analogies to it in cytological facts known in other animals. Several different types of multiple elements, formed by definite chromosome-couplings, are now known. An example is given by *Metapodius* (which I have recently described in detail). In individuals having "supernumerary" chromosomes these regularly couple with the idiochromosome-bivalent in the second division to form triad, tetrad, pentad and even hexad complexes; and the components are often arranged in linear series. I have recently obtained an individual of *M. femoratus* which differs from all other individuals of the species thus far examined in possessing a single odd or accessory chromosome, while the missing small idiochromosome is replaced by a third "*m*-chromosome." The latter does not, as might have been expected, play the part of a synaptic mate to the odd chromosome, but shows throughout the spermatogenesis the characteristic behavior of its own kind. In the first division it is always coupled with the two other *m*-chromosomes to form a triad element, the three components almost always forming a linear series. Again, in *Thyanta* there are three sex-chromosomes (the Y-element and two components of the X-element) which divide separately in the first division but are always coupled in the second to form a linear triad series. In the reduvioids, as Payne has recently shown, the sex-chromosomes form in the second division dyad, triad or tetrad groups; in *Gelastocoris* they form a pentad complex; and in each case the components show a definite arrangement and mode of distribution.

A closer approximation to the secondary coupling suggested in *Abraxas* is given by the observation of Sinéty on *Leptynia* (one of the Phasmidæ), and especially by the discoveries of McClung in *Hesperotettix* and some other Acrididæ, that the X-element (accessory chromosome) is in these cases regularly coupled in the maturation-divisions with one of the

bivalents. I have found a somewhat similar condition in the coreid *Pachylis,* though the coupling is here less constant. The most significant fact, emphasized by McClung, is that in *Hesperotettix* the odd chromosome always couples with a particular bivalent that can be distinguished from the others by its size. Such a phenomenon is evidently to a certain extent of the same type as the secondary coupling surmised above as the possible explanation of the facts in *Abraxas;* and it would be most interesting to attempt crossing experiments with these grasshoppers from the point of view that is thus suggested.

Professor Castle's tempting suggestion that the Y-element in the ordinary forms of insects may be the vehicle for the transmission of secondary male characters that are not represented in the female interests me because I had considered an identical view but withheld it for two reasons. One was that in forms like *Pachylis, Archimerus,* etc., where the Y-element is wanting, the male secondary characters are as well developed and characteristic as in forms where the Y-element is present. The other is given by the facts in *Metapodius* (since published in the fifth of my "Studies on Chromosomes"). In this case the evidence is nearly if not quite conclusive that the "supernumerary" chromosomes are duplicates of the Y-element; and they are found indifferently in either sex. The closest scrutiny of the original specimens (now in my cabinet) fails to show any trace of the male secondary characters in those females that possess supernumeraries. Since these characters are very conspicuous in *Metapodius* a decisive negative seems to be given to Castle's suggestion, as far at least as three species of this genus are concerned. The Y-element still remains a puzzle; and until it has been satisfactorily accounted for our cytological view of the problem will remain defective.

EDMUND B. WILSON

THE NATIONAL ACADEMY OF SCIENCES

THE National Academy of Sciences held its annual meeting at Washington on April 20, 21 and 22. The members in attendance were:

Henry L. Abbot, Alexander Agassiz, J. A. Allen, George F. Becker, John S. Billings, Franz Boas, William H. Brewer, George J. Brush, J. McK. Cattell, Charles F. Chandler, Russell H. Chittenden, W. B. Clark, George C. Comstock, E. G. Conklin, James M. Crafts, Whitman Cross, William H. Dall, W. M. Davis, W. L. Elkin, S. F. Emmons, W. G. Farlow, Edwin B. Frost, Theo. Gill, Arnold Hague, William F. Hillebrand, William H. Holmes, Joseph P. Iddings, C. Hart Merriam, S. Weir Mitchell, Edward W. Morley, Edward S. Morse, Edward L. Nichols, H. F. Osborn, Michael I. Pupin, Ira Remsen, W. B. Scott, Charles D. Walcott, Arthur G. Webster, William H. Welch, Charles A. White, Edmund B. Wilson, Robert S. Woodward.

The program of scientific papers was as follows:

"The Nature and Possible Origin of the Milky Way," G. C. Comstock.

"Determinations of Stellar Parallax from Photographs made by Arthur R. Hincks and the writer," H. N. Russel (introduced by G. C. Comstock).

"Strange Ceremonial Costumes of California Indians" (with lantern slides), C. Hart Merriam.

"Archeological Problems of the Titicacan Plateau" (with lantern slides), W. H. Holmes.

"Discovery of a Complete Skeleton of *Tyrranosaurus* in the Upper Cretaceous" (with lantern slides), H. F. Osborn.

"An Iguanodont Dinosaur (*Trachodon*) with the Epidermis Preserved" (with lantern slides), H. F. Osborn.

"Stratigraphic Relations and Paleontology of the Lower Member of the Fort Union Formation," F. H. Knowlton (introduced by Whitman Cross).

"The Deep-sea Bottom of the Eastern Tropical Pacific, from Observations on the *Albatross* Expedition," Sir John Murray (communicated by A. Agassiz).

"The Medusæ of the Eastern Tropical Pacific, from Observations on the *Albatross* Expedition," H. B. Bigelow (communicated by A. Agassiz).

"Mythology of the Mewan Indians of California," C. Hart Merriam.

"The Radiation from Gases heated by Sudden Compression," E. F. Nichols and G. P. Pegram.

"Biographical Memoir of Elliott Coues," J. A. Allen.

"Biographical Memoir of Ogden N. Rood," E. L. Nichols.

"The Electrolytic Separation of the Chlorides of Barium and Radium," Edgar F. Smith.

"The Orders of Teleostomous Fishes (Pisces)," Theo. Gill.

"Biographical Memoir of Chas. A. Schott," Cleveland Abbe.

"The Distribution of the Recent Crinoids," Austin H. Clark (introduced by Theo. Gill).

"On the Distribution of Energy in the Spectrum of the Light from Fluorescent Substances," E. L. Nichols and Ernest Merritt.

"A Geographical Excursion in Northern Italy," W. M. Davis.

THE AMERICAN SOCIETY OF NATURALISTS

The annual meeting of the American Society of Naturalists was held in the auditorium of the Physiological Building, Johns Hopkins Medical School, Baltimore, Md., December 31, 1908. Fifty-five members were present.

On vote of the society the address of the retiring president, Professor D. P. Penhallow, in his absence, was read by the chairman, Professor T. H. Morgan. It is printed herewith.

A discussion of the functions and relations of the society followed, participated in by delegates from some of the affiliated societies and by Professors Minot, Davenport, Baldwin and Cattell. This resulted in an emphatic vote in favor of preserving the integrity of the society and of establishing a more effective cooperation between its sections. Professor C. B. Davenport offered a motion that the constitution be amended so that the executive committee of the Naturalists be composed of the secretaries of Sections F, G and K of the American Association and of the secretaries of the technical biological societies affiliated with the Naturalists, the same to form a program committee for the arrangement of papers, times and places of meeting, etc. This motion was referred to the executive committee with power to act.

Professor T. H. Morgan, on behalf of the executive committee, moved first that the study of evolution be the general policy of the society for the ensuing year; second, that the program consist of original contributions on the subject of evolution and of reports, demonstrations, etc., of important recent work in this field. The society voted to adopt this program for the current year. Members from the affiliated societies are accordingly requested to reserve contributions bearing on this topic for presentation before the Naturalists at the next annual meeting.

The place and time of the next meeting was referred to the executive committee.

Eleven new members were elected; they are: D. S. Johnson, Johns Hopkins University; R. C. Osburn, Barnard College; G. G. Scott, College of City of New York; A. H. Clark, National Museum; L. L. Woodruff, Yale University; N. E. Kellicott, Woman's College of Baltimore, Md.; R. P. Cowles, Johns Hopkins University; J. F. McClendon, University of Missouri; F. B. Sumner, Woods Hole; A. A. Budington, Oberlin College; R. Retzer, Johns Hopkins Medical School.

At an adjourned meeting in the evening the following officers were elected for this year:

President—Professor T. H. Morgan, of Columbia University.

Vice-president and Chairman of the Eastern Section—Professor W. H. Howell, Johns Hopkins University.

Additional Members of the Council—Dr. D. T. MacDougall and Professor Charles H. Judd.

Treasurer—Dr. Herman von Schrenck.

Secretary—Dr. H. McE. Knower.

Professor R. A. Harper, University of Wisconsin, is vice-president and chairman of the Central Branch of the society, and Professor J. G. Lee, University of Minnesota, is secretary of the Central Branch.

H. McE. Knower,
Secretary

REPORT OF THE BALTIMORE MEETING OF THE AMERICAN FEDERATION OF TEACHERS OF THE MATHEMATICAL AND THE NATURAL SCIENCES

The council of the federation met in Baltimore, Md., on Monday, December 28, at 3 P.M. Of the thirty-three members of the council, nineteen were present either in person or by proxies. The report of the executive committee, presented by Mr. J. T. Rorer, outlined the work of the year in connection with organization, the appointment of a special committee on the bibliography of science teaching, the issue of the November *Bulletin*, and preparations for the council meeting in Baltimore. It pointed out some of the specific questions which might naturally engage the attention of the officers of the federation during the coming year; emphasizing, however, the dependence of successful work on increased financial resources.

The treasurer reported a balance of $20.20 from last year, as shown in the printed statement in the *Bulletin*. The printing and mailing of the *Bulletin* had cost $53.00, leaving $32.80 chargeable to this year's account. Dues from the federated associations for this year had not yet been collected. An auditing committee, consisting of Messrs. L. S. Hulbert and C. H. Smith, was ap-

pointed, and reported later that the accounts were correct.

Interesting reports in regard to organization and methods of work were presented from the following local societies: The Association of Mathematical Teachers in New England, presented by Mr. W. T. Campbell; The Association of Teachers of Mathematics of the Middle States and Maryland, presented by Mr. Eugene R. Smith; The Physics Club of New York, by Mr. F. B. Spaulding; The Association of Biology Teachers of New York, by Mr. G. W. Hunter; The Association of Physics Teachers of Washington, D. C., by Mr. W. A. Hedrick; The New England Association of Chemistry Teachers, by Mr. H. P. Talbot; The Central Association of Science and Mathematics Teachers, by Mr. C. H. Smith; The Colorado Mathematical Society, by Mr. G. B. Halsted; The Southern California Science Association, by Miss T. A. Brookman. All the reports showed active and constructive work under way.

By unanimous consent the following article was added to the articles of federation as adopted at the Chicago meeting:

13. These articles may be amended at any annual meeting of the council by a two thirds vote of the members present provided notice of the proposed amendment has been sent to all members of the council and to the president and secretary of each federated society at least thirty days prior to the meeting.

The following resolutions were unanimously passed:

Resolved, That it is the sense of the American Federation of Teachers of the Mathematical and the Natural Sciences that larger appropriations should be made by Congress for the support of the United States Bureau of Education so as to enable it greatly to increase the scope and importance of its work and to render immediate and effective aid in the promotion of education in the mathematical and the natural sciences; and

Resolved, That the executive committee of the federation be authorized to take such action as may seem to it desirable to further such action by Congress.

Three committees of the federation were authorized as follows: One on a syllabus of propositions in geometry; one on publication and publicity, to report next year on the present needs and facilities for publishing material of interest to the federation, and to make recommendations as to ways and means of improving these facilities; one to investigate the present conditions of college entrance, to define the attitude of the federation towards college entrance problems, and to recommend action that may tend to unify and simplify college entrance requirements.

The following were elected officers for the coming year:

President—H. W. Tyler, Massachusetts Institute of Technology.

Secretary-treasurer—C. R. Mann, University of Chicago.

Other Members of the Executive Committee—G. W. Hunter, DeWitt Clinton High School, New York; J. T. Rorer, Central High School, Philadelphia; C. H. Smith, Hyde Park High School, Chicago.

Professor R. E. Dodge presented a report of progress from the committee on bibliography, showing that the sections on mathematics, physics, biology and geography were nearly completed.

A letter from Professor D. E. Smith, representing the International Commission on the Teaching of Mathematics, was presented, expressing the hope that the federation would cooperate in its undertaking in due time.

On Tuesday morning, December 30, the federation held a joint session with Section L, Education, of the American Association for the Advancement of Science. The topic, "The Problems of Science Teaching," was discussed by President Ira Remsen and Messrs. G. F. Stradling (Philadelphia), Wm. T. Campbell (Boston), John M. Coulter (Chicago), N. M. Fennemann (Cincinnati) and Lyman C. Newell (Boston), as follows:

President Remsen said:

"A battle that has long been waging has been won—the battle for the recognition of science in the courses of study in schools and colleges. I remember well my first experience as a teacher of chemistry. I had accepted a position in one of the small New England colleges without having examined the equipment. When I arrived in the fall ready to begin work, I found that the institution did not possess a laboratory. I at once applied to the president for one, and he replied: 'What for? I have taught chemistry, and I thought successfully, without a laboratory; and if I could do it, I think you can. This is not a technical school; what the students want is the broad general principles of chemistry.' So I tried to teach without a laboratory. I was wholly unsuccessful; the students learned nothing—in

fact, some of them told me so in later years. The experience was, however, very useful to me, for I learned a great deal from it.

"Now science is recognized; we have laboratories everywhere and laboratory training is regarded as indispensable. It is therefore fitting to ask: What are we doing with our facilities? What results are we obtaining? When the battle was on, men lost their heads—men must lose their heads in order to fight. We thought that if only we could get laboratories, the problems of education would be solved. Is this true?

"Pedagogical problems are hard to solve—it is very difficult to get sound conclusions. How can we tell whether the scientific training is more effective than that of the older type? This is a problem that can not be solved by sitting down and thinking about it; it can be solved only by research and experiment. I do not myself know whether scientific training as now conducted is producing the results hoped for. Yet I am convinced that scientific training, when properly conducted, may be of the greatest value as an educational force. This is quite a different thing from saying that that particular thing now known as science training is of great value. It all depends upon how it is done.

"Personally, I have been guilty of all the sins possible for a teacher of science. I have been experimenting to find out how to teach chemistry; and it is the most difficult experiment I have ever tried. My own experience in school was very instructive to me, for my own education was most unsatisfactory—in fact, I never was educated. My first experience with chemistry was gained in a course of lectures one hour a week by one of the greatest chemists of this country, Professor Wolcott Gibbs. Yet from this course I learned nothing. My second experience came when I had taken up the study of medicine. The teacher knew little chemistry, and I was asked to assist him in preparing the experiments for his lectures. He had a large practise, and left me alone to prepare experiments that I had never seen. I am almost ashamed to confess what happened that year—there were explosions and fires and bungling beyond words. I had little or no guidance.

"In my first course the instruction had been 'theoretical'; in the second I had the 'practical' galore; I therefore thought I was an experienced chemist and could go on and take an advanced course. It was a sad awakening when I found that I knew practically nothing of the subject.

"But to return to our theme: Are we doing the best that is possible with what we now have? Do the results obtained justify the equipment and time devoted to scientific study? I am not qualified to answer these questions for the schools; but speaking for the colleges, I may say that, in my opinion, the results are frequently quite unsatisfactory. The reason is that we have not yet learned how to deal with the subject. It is not hard to teach chemists chemistry, but it is very hard to teach beginners something that is worth while about chemistry in one year. What can be expected of a one-year course? Have you ever seen students who obtained an intelligent knowledge of any subject in one year? We can not expect anything of great value in that limited time. If getting knowledge of a subject is the purpose, we can not expect much of even the best teachers. But the important point is: Are we doing the best we can under the circumstances?

"There are two points in which, it seems to me, we might do better—two defects that might be remedied. One defect is that the student is not subject to enough supervision in his laboratory work. He is very much in the condition in which I found myself when turned loose in the laboratory to prepare experiments I had never seen. He is turned loose with a book, and then left alone. This is not conducive to scientific work. School authorities do not realize the need of enough teachers for the sciences. The head teacher generally expounds the subject and leaves the laboratory work to inexperienced assistants. It is too much work for the professor to have to spend four or five hours a day in the laboratory with the students. If we could get teachers with interest in their subject and in their students, it would solve the problem; but in science as in other subjects, we are not going to find these often. Unless we can find out how to produce good teachers, we shall fail to get the best results.

"The second important defect in the present teaching of chemistry in college is the absence of repetition. There are too many fleeting impressions. There is a little about a great number of things, as oxygen, hydrogen, chlorine, nitrogen, phosphorus—each being treated as something new with no reminders. In language there is much repetition; each new lesson continually connects with past work. Yet it is only by repetition that we learn. We do not learn a game by being told

how to play and then trying it once. Repetition is largely lacking in science teaching. We cover too much ground. The student gets only a veneer.

Knowledge of this sort is not of much use, and the drill given by such study is not effective. We must introduce into science teaching the drill element that comes only from repetition of the sort that is characteristic of languages and mathematics.

"Chemistry has one kind of work involving repetition of the right sort, namely, qualitative analysis. This field offers good educational possibilities, but the work is in great danger of becoming mechanical. The student is prone to go through the motions with his mind on his book, to guess at the results, to report, watching the reaction of the teacher closely, and to get credit. In order to introduce this element of repetition, quantitative work has been introduced to save the situation. Some quantitative work is desirable. It makes it possible to keep a student at one experiment till he has obtained good results. Such work is monotonous, though it has the advantage of not requiring the student to cover too much ground.

"The remedy for these two important defects is, unfortunately, unattainable at present. We must get good teachers. Much is being done in the way of training teachers, and much that is good is coming from this work. Yet we must not forget that good teachers are not easily made. It is harder to train a teacher to conduct laboratory work efficiently than to train one to teach mathematics or a language. In science the laboratory presents a new problem, and serious errors have occurred and are occurring. Yet, in spite of this, great progress is being made, and there is little doubt that in the end scientific training will fully justify itself in the schools and colleges.

"In closing let me again specifically state that I do not consider myself competent to speak of science training in the secondary schools; all that I have been saying applies, as far as my own definite knowledge goes, only to the colleges."

Dr. G. F. Stradling showed that there has been no notable change within the past decade in the relation of doctorates in physics to the whole number conferred in the United States, nor has any notable change in the proportion of students offering physics upon entrance to college taken place. There has, however, been a very marked decrease in the percentage of all high school students taking physics.

From 1890 to 1906 the high school population became two and three fourths times as great, while the number of students of physics merely doubled. Had the ratio of 1890 held unchanged, 49,000 more students would have been studying physics in the high schools in 1906. In 1890 about 21.3 per cent. of all high school students studied physics, in 1906 only 15.5 per cent. For chemistry the numbers are 9.6 and 6.8. Every year since 1894, without exception, has shown a smaller percentage of students in physics.

From 1890 to 1906 the percentage of Latin students grew from 33.6 to 50 per cent.; of German students, from 11.5 to 21 per cent.; of algebra students, from 43 to 57.6 per cent.

Chemistry, astronomy, physiology, geology and physical geography all are losing ground in the high school. The sum of the percentages of students in these branches and in physics in the period named fell from 93 to 67 per cent., while the sum for Latin, Greek, French and German rose from 71 to 84 per cent.

Causes suggested for these changes were: (1) introduction of a wider system of electives; (2) lack of well-prepared teachers, and (3) change in the method of teaching.

A commission of the caliber of the committee of ten ought to investigate thoroughly the conditions of science teaching in the United States. An increased appropriation from Congress to the Bureau of Education would help to bring about such an investigation.

Mr. William T. Campbell, of the Boston Latin School, claimed that more attention is needed to the care of students of average mathematical ability. Under the elective system these drift into other paths. Something has been done to make the subject more attractive to them; but more remains to do. It is doubtful whether our present course, even if improved, will meet the situation. Considerable change in the direction of practical work and of closer connection with other sciences is needed.

Professor Coulter pointed out that, while the problems of the teaching of botany were constantly changing, those at present most urgent seem to be: (1) to get the prepared teacher who has a general knowledge of the fundamentals of botany, clear conceptions of the purpose of botany in the secondary schools as distinguished from higher institutions, and ability to attack the subject in a variety of ways; (2) the place of economic

botany or agriculture in the botanical instruction; (3) the biological grouping of subjects; (4) the holding of the interest of the students, *i. e.*, the finding of the effective point of contact for botany with students who are looking for practical values. No formulation of the value of botany can be made until these problems have been settled. The time is now ripe for a well-organized investigation, to be followed by a statement of well-established conclusions.

A full report of the meeting will be issued in pamplet form early in May. This will be sent to the members of the federation. Any one may obtain copies by applying to the secretary.

C. R. MANN,
Secretary

THE UNIVERSITY OF CHICAGO

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE SECTION F (ZOOLOGY)

THE vice-presidential address at the Baltimore meeting was delivered by Professor E. B. Wilson. It was published in SCIENCE, January 8, 1909.

The secretary has received abstracts of papers read as follows:

Brood-protection and Sexual Dimorphism among Echinoderms: HUBERT LYMAN CLARK, Harvard University.

The large number of echinoderms now known (about fifty) which protect or care for their young in some way show great diversity in the method used. The eggs may develop outside the body of the parent or more rarely within the body-cavity or in special reproductive cavities. If developed outside the body, the young may become attached to some part of the parent, or be sheltered among her spines or covering plates, or simply be brooded beneath her ventral surface. If developed within the parent, the young may swim about freely in the body-cavity, or more rarely undergo their development in the reproductive organs, which are thus practically uteri.

Among all these brood-protecting species, however, there seem to be only half a dozen (about twelve per cent.) which occur in tropical waters, while more than sixty per cent. are found in Antarctic or South Temperate seas.

Only four species, and these all from between 30° and 60° S. latitude, show any marked sexual dimorphism. In one, an ophiuran, the male has only five arms, the female, six to eight (Koehler). In another, a holothurian, the development of a peculiar brood-chamber in the dorsal integument distinguishes the female. The third is a spatangoid in which the lateral petals of the female are much broader and deeper than those of the male and serve as brood-pouches. The fourth is a clypeastroid, recently discovered in the Australian collections of the "Thetis," in which the abactinal area of the female is deeply depressed to form a horseshoe-shaped brood-chamber, wholly wanting in the male.

Notes on the Eggs of the Anura of Ithaca, N. Y.: ALBERT H. WRIGHT, Cornell University.

Eight species of Anura are found at Ithaca, N. Y., namely: *Rana sylvatica, Hyla pickeringii, Rana pipiens, Bufo lentiginosus americanus, Rana palustris, Hyla versicolor, Rana clamitans* and *Rana catesbiana.*

The first five species appear from hibernation and spawn under a maximum air temperature of 43–50° F.; the last three delay until the maximum reaches 70° F. or more. The first five usually breed from the last of March until the middle of June; the last three, from the last of May into August. All but two species, *Bufo l. americanus* and *Rana clamitans*, occupy four or five weeks for the spawning period. The exceptions may require two or three months. The number of eggs may vary from 800 in *Hyla pickeringii* to 20,000 in *Rana catesbiana.*

The eggs of three species, *Hyla versicolor, Rana clamitans* and *Rana catesbiana*, float more or less at the surface of the water; the eggs of the other five are submerged. The five species with submerged eggs are the first to breed. They deposit eggs with firm jelly envelopes, several eggs appearing at an emission except in *Hyla pickeringii*, where only one appears at an emission. The three with buoyant eggs breed after May 25. They deposit at the surface masses or films of eggs with loose jelly envelopes, several eggs being deposited at an emission. The best differential egg characters are: the manner of deposition, the nature of the jelly envelopes, the color of the vitellus, the diameters of the vitellus and jelly envelopes, the number of eggs and the season of deposition.

Factors Determining the Movement of Melanin Pigment Granules: OSCAR RIDDLE, University of Chicago.

Movement of these particles from one part of the cell plasma to another, and from one cell to another, is probably determined either by the solubility properties or by the electrical state of the granules. Author obtained no evidence of solubility. The granules are, however, definitely proven to be colloidal bodies bearing a negative

electrical charge—the granules unfailingly moving toward the anode when placed in an electrical field of light intensity. The author thinks this explains not only the movements of independent granules, but the movements of some chromatophores as a whole—as for example the skin chromatophores of lower vertebrates and the retinal pigment of arthropods and vertebrates. And, finally, this fact is of very considerable importance in a consideration of the physiology of color inheritance.

The Rate of Digestion in Cold-blooded Vertebrates in Relation to Temperature: Oscar Riddle, University of Chicago.

By the use of Mett's tubes and a constant temperature tank, information was sought and obtained from cold-blooded vertebrates on the following points: (1) A definite measure of the rapidity of digestion, (2) comparison of this rate in fishes, amphibians and reptilia, (3) seasonal variations in digestive power, (4) a direct and definite measure of the effect of raising or lowering the temperature of the animals, on their rate of digestion, (5) the temperature coefficients of digestion in these animals.

It appears that a gradual loss of digestive capacity has occurred in the amphibia and reptilia during their evolution; and the bearing of this fact on the development of warm-bloodedness in the vertebrata seems to merit attention.

The Hyo-branchial Apparatus of Typhlotriton: Wm. A. Hilton, Cornell University, Ithaca, N. Y.

The hyo-branchial skeleton of *Typhlotriton spelæus* in the adult resembles *Spelerpes* rather than members of the family Desmognathidæ in which it has been placed. The hyo-branchial skeleton of the larva resembles *Spelerpes* much more than the larva of *Desmognathus.* Like *Spelerpes* it has but three branchial arches, while *Desmognathus* has four.

Typhlotriton is a cave form, but from its eyes and other structures it seems to have much more recently come to such an environment than *Typhlomolge.* The hyo-branchial apparatus of *Typhlotriton* larva is almost the same as that of the supposed adult, but possible larval form of *Typhlomolge.*

A series of apparently related species beginning with those living in caves only to a slight degree and ending with those best adapted to a subterranean life, is as follows: (1) *Spelerpes longicaudus,* (2) *Spelerpes maculicaudus,* (3) *Typhlotriton spelæus,* (4) *Typhlomolge rathbuni.*

Some Egg-laying Habits of Amphitrite: John W. Scott, Kansas City, Mo.

(1) The egg-laying reflex of *A. ornata* is closely associated with the time of spring tide, the height of any given period of egg-laying always occurring within three days of the time of new or full moon. In early summer the period of sexual activity tends to occur after, in late summer before, spring tide. (2) Eggs and sperm float free in the body-cavity, and are usually in various stages of development. Ripe eggs show the metaphase of the first maturation spindle, and eggs in this stage have a greater density than unripe eggs. It is entirely probable that the apparent selection of ripe and rejection of unripe eggs by the nephridia is due to the different effects produced by nephridial currents upon bodies of differing densities.

Bilateral Symmetry in the Development of the Primary Septa of a Living Coral: J. W. Mavor, Cambridge, Mass.

The usual bilateral symmetry in the development of the first six pairs of mesenteries is shown to occur in *Agaricia fragilis.* The six primary septa are found to be arranged about a plane of bilateral symmetry which is the same as that for the soft parts, and the exosepta are found to arise in bilateral pairs. The bilateral symmetry of the primary septa is found to persist in later stages with well developed epitheca and exosepta. The arrangement of the primary septa in *Agaricia* is different from that in *Siderastræa radians* as described by Duerden, but agrees with that in *Lophophyllum proliferum* as described by the same author.

Autotomy of the Hydranth of Tubularia: Max Morse, College of the City of N. Y.

Hydroids commonly absorb their hydranths when placed under artificial conditions. *Tubularia* is an exception, and pinches off the hydranth entirely from the stem. Later it regenerates a new hydranth. There is no disintegration of the cells until after the hydranth has fallen off. Temperature is the active factor in inducing the process; hence *Tubularia* naturally occur fully developed at certain definite periods.

Rôle of the Nerve System in Regeneration in Earthworm and Newt: A. J. Goldfarb, Columbia University.

The accumulated evidence points to the conclusion that early embryos and larvæ can regenerate missing organs independently of morphogenic influences exerted by or through the nerve system. Concerning the rôle of the nerve system in adults

there is a great diversity of opinion. Experiments upon the earthworm were intended to reexamine the evidence with regard to the influence of the nerve cord on the regeneration of the head. Removal of the cord from the amputated end, for a distance sufficient to prevent innervation of that end, did not inhibit the formation of a functional head.

After determining the number and origin of the nerves supplying the rear limbs and different levels of the tail in the common newt, *Diemyctelus viridescens*, the cells from which these nerves arise were totally destroyed, in both the nerve cord and the ganglia. The cord in the adjoining regions was also destroyed to prevent secondary innervation. Subsequent examination of serial sections established the fact that both the tail and the rear limbs replaced missing parts in the total absence of nerve stimuli, that where under certain special conditions regeneration did not take place, the motor and sensory functional nerves at the amputated end were unable to stimulate the organ to regenerate the lost parts.

Nuclear Components of the Sex-cells of Cockroaches: MAX MORSE, College of the City of New York.

The author presented evidence for: (1) A sex-difference in the chromosomes of the ovary and testis cells, (2) reduction by parasynapsis involving two longitudinal divisions of the chromosomes, (3) the absolute distinction between plasmosome (achromatic nucleolus) and the odd chromosome, contrary to Moore and Robinson, Foot and Strobell, Arnold and others, (4) the individuality of the chromosomes.

Featherless Fowls: R. H. CHAPMAN, U. S. Geological Survey.

The writer called attention to an abnormal condition in chickens seen by him at Delhi, N. Y., during summer and fall of 1908. Some 500 birds of the barred Plymouth Rock breed were incubator hatched between June 5 and 20. Of this number about ten per cent. failed to develop normally—a small number were deformed or became "crazy" after a short time and all (of the ten per cent.) failed in bodily growth and normal feathering. By November 10 all of the naked birds had died. The eggs had come from a farm in the vicinity and the parent birds had been inbred for four or five years.

On the Skull and the Brain of Triceratops: O. P. HAY, Washington, D. C.

This paper questions the correctness of the accepted view that the frill of *Triceratops* has as its median element the parietal bone. This median element is either a greatly developed nuchal scute or coalesced supratemporal bone. The parietal is that bone which has hitherto been called the supraoccipital. The foramen that Marsh called the pineal foramen, by others the postfrontal foramen, is properly the coalesced supratemporal foramina.

On the Intellect of Animals: ALEXANDER PETRUNKEWITCH, Short Hills, N. J.

Since man can judge of the thinking processes in animals from their actions only, the chief problem is to establish the relation between thought and actions. Conclusions from actions as to presence or absence of reasoning are often based on too little evidence and admit different interpretations. The chief difference in actions of man and those of animals is usually found in the absence of choice in animals. The conclusion which the author supported by new evidence is that reasoning has been gradually developed with the progress of evolution and is certainly to be found in its simpler forms in some higher mammals at least.

Olfactory Nerve, Nervus Terminalis and Preoptic Sympathetic System in Amia calva: CHAS. BROOKOVER, Buchtel College.

The olfactory nerve arises from an ectodermal placode in *Amia.* Nuclei migrate from the placode along the olfactory nerve toward the brain. Some of these nuclei produce sheath cells of the olfactory nerve. Others of the nuclei become enlarged, produce a ganglion two days after hatching, and when the fish is 50 mm. long number about two hundred and fifty cells. Allis homologized this ganglion and its nerve with Pinkus's nerve in *Protopterus.* There are nearly a thousand cells in each adult nasal capsule of *Amia.* They show Nissl bodies. Some are multipolar nerve cells. It is suggested from their relation to the blood vessels that these ganglion cells are vaso-motor in function. About fifty coarse fibers differing from olfactory fibers are found entering the olfactory bulbs. Other fibers extend posteriorly ventrally of the brain. A nervus terminalis is present in *Lepidosteus* and teleosts.

Nerve fibers with ganglion cells inside the cranial cavity were found entering from the profundus branch of the fifth nerve. These fibers innervate the paraphysis and blood vessels of the meninges of the forebrain. Some of the fibers extend forward as far as the nerve of Pinkus (nervus terminalis) and may form a sympathetic

connection with the latter nerve. The pineal stalk is innervated by a bundle of about thirty fibers connecting with the brain just caudad of the habenular body. Intravitam methylene blue preparations of the stalk of the epiphysis show ganglion cells with an interlacing plexus of fibers very similar to the sympathetic innervation of the walls of the intestines of vertebrates.

Effects of Brachycephaly and Dolichocephaly upon the Teeth of Man: RAYMOND C. OSBURN, Barnard College, Columbia University.

A study of various types of skulls to show the variations in the dental arch, and especially in the teeth themselves. The principles which have been stated by Professor H. F. Osborn (*Bul. Am. Mus. Nat. Hist.*, Vol. XVI., art. 7) as operating in various groups of lower mammals are here shown in man within the limits of a single species.

Some Noteworthy Additions to the Bryozoan Fauna of our Atlantic Coast: R. C. OSBURN, Columbia University.

A series of lantern slides showing various families, genera and species of Bryozoa new to our east coast fauna. A preliminary report of certain of the more striking forms collected by the author at the Tortugas, Beaufort and Woods Hole stations.

Fission and Regeneration in Sagartia luciæ: D. W. DAVIS, Sweet Briar College, Va.

The sexually derived, undivided individual in *S. luciæ* is probably a regular hexamerous form with six pairs of complete mesenteries. Of these, two pairs situated at opposite ends of the major transverse axis are directives and each directive pair is associated with a siphonoglyph. A secondary cycle, of incomplete mesenteries arranged in pairs, alternates with the pairs of the first cycle. A third cycle is usually present, and even a fourth may be represented. Longitudinal division is so common that such undivided animals are rare, and fission followed by regeneration plays an important part in the life-history. Fission occurs, almost without exception, in endocœls and, in about two thirds of the cases examined, in complete endocœls. The fission-plane shows a decided tendency to pass at right angles with the major transverse axis, producing bilaterally symmetrical pieces, but with little regard to an accurate halving of the dividing animal.

In regeneration, from eight to ten complete mesenteries are formed, the precise number depending upon the complete or incomplete character of the mesenteries at the boundaries of the old part. The new mesenteries are formed in a characteristic succession not harmonizing with an *Edwardsia* type of development but corresponding to the order described by the Hertwigs for two (possibly regenerating) specimens of *Adamsia.*

Reactions of the Dogfish to Chemical Stimuli: R. E. SHELDON, University of Chicago.

The smooth dogfish, *Mustelus canis* (Mitch.), was tested over the entire body surface, mouth, spiracle and nostrils with acid, saline, alkaline, sweet and bitter substances. The fish was found to be very sensitive over the entire surface to acids and alkalis in very dilute solution. It is less sensitive to salts and bitter substances and does not react at all to sweet solutions. The general body surface, particularly the fins, are more sensitive to alkalis and salts than is the mouth; both are equally sensitive to acids, while the mouth is the more sensitive to bitter substances. When the spinal cord is destroyed no reactions are obtained from the caudal part of the body, showing that the lateral line nerves have nothing to do with these reactions. When the cord is severed from the brain, the caudal part of the animal is more sensitive than before to chemical stimuli. There is no spinal shock after section of the cord. The nostrils are very sensitive to alkalis, acids, salts and bitter solutions. Section of the olfactory crura and different rami of the trigeminus nerve showed that this sensitiveness is due to the maxillaris nerve rather than the olfactory. Parts of the body were overstimulated for tactile response, after which they could always be stimulated chemically. When any region was overstimulated for any given chemical, as an acid, it rarely responded to tactile stimuli, although it usually responded to other chemical stimuli, as a saline or alkaline solution. When cocaine was applied to the skin, tactile response disappeared before chemical. Among the different chemical senses, bitter disappeared first. This sensitiveness to chemical stimuli is due almost exclusively to the nerves of general sensation, not at all to the olfactory nerve and very little, if any, to the gustatory nerves.

Chondrocranium of an Embryo Pig: CHAS. S. MEAD, New York City.

The study of the chondrocranium of *Sus* is of value not only in assisting us to understand the structure of the adult skull in this form, but also on account of its bearing on the general morphology of the mammalian cranium. Owing to its relatively low position in the ungulate series, we would expect many primitive characters to be retained in its cartilaginous cranium, and indeed

this is the fact, for a number of reptilian characters are present.

The notochord, near the middle of its passage through the skull, dips beneath the basal plate and is connected with the dorsal wall of the pharynx in two places. The cartilages which will later form the ear-bones are of the type common to the mammals at this stage of development. A foramen nervus abducens is present. It is in the same position as the similarly named foramen in the reptiles, but the two are not homologous, that in *Sus* being secondary. The cranial cavities in the reptiles and mammals are not strictly homologous, but the cavity in the mammals is larger morphologically than that of the reptiles and has been increased by the addition of the reptilian cavum epiptericum. Vestiges of the primitive side wall of the cranium are found in *Sus*. Taken as a whole, the chondrocranium of the pig is that of a generalized mammalian type. It shows certain specialized characters such as the narrowed anterior portion of the basal plate, the large size of the ear capsules, and the secondary foramen nervus abducens, but these are less striking than the secondary characters of *Echidna*, *Talpa*, *Lepus* or the Primates.

Placentation of an Armadillo: H. H. LANE, State University of Oklahoma.

The placentation of the Edentates has not been thoroughly studied and only a few observations have been recorded. A female nine-banded armadillo (*Tatu novemcinctum*) in captivity gave birth to four young, and an examination of the deciduate placenta revealed some novel features. There was a complete fusion of the four chorionic vesicles into one. The four amnia were united so as to divide the chorionic cavity into four longitudinal chambers, each with a single umbilical cord attached to its wall. In this specimen the placenta is intermediate in form between the zonary and the discoidal. The villi are present in a broad band surrounding the chorionic vesicle, which is barrel-shaped and has thin membranous ends devoid of villi. The villous band is made up of two disc-shaped areas of very long villi, separated by two bands of very short villi. Each of the two areas with long villi has on its amniotic surface the points of attachment of two umbilical cords. There is no indication of a decidua capsularis. This highly developed placenta would indicate that the armadillo is a specialized form, instead of a primitive type; and if this character is of systematic value, the Edentata are to be regarded as a heterogeneous group and not a natural one.

Cestodes in Flesh of Marine Fishes: EDWIN LINTON, Washington and Jefferson College.

The only common food fishes found to harbor cestodes habitually in the flesh are the butterfish (*Rhombus triacanthus*) and the harvest fish (*R. paru*). The cestode is *Otobothrium crenacolle*. The adult stage has been found in the hammerhead shark (*Sphyrna zygæna*) in New England waters, in the sharp-nosed shark (*Scoliodon terræ-novæ*) at Beaufort, and in the cub shark (*Carcharhinus platyodon*) at Tortugas.

In the encysted stage it has been found in twelve species of Woods Hole fishes, in thirteen species of Beaufort fishes and in three species of Bermuda fishes. In all these, with the exception of the butterfish and harvest fish, the parasites were confined to the body cavity where they were encysted on the viscera or in the walls of the stomach and intestine. In the summer of 1908, butterfish to the number of 715 were examined and cysts were found in all but 22. Twelve harvest fish were examined and numerous cysts were found in each. The paper discusses the exceptional position of these cysts in the butterfish and the unusually high percentage of affected fish.

Systematic Relations of the Urodela as Interpreted by a Study of the Sound-transmitting Organs: H. D. REED, Ithaca, N. Y.

This study is the result of the curiosity aroused by the apparent conflicting statements regarding the systematic position and relationships of the various groups of Urodela. Believing that the limits and position of some of the larger groups have been based upon structures which are either affected by environment or negative in their character, and, furthermore, believing that the classification of any group is sounder when based upon results gained from a comparative study of several organs or systems, it was decided to place in evidence a comparative study of the sound-transmitting organs already under investigation with another end in view.

Cryptobranchus is the most generalized. The Ambystomidæ are intermediate between *Cryptobranchus* and all other groups. The Plethodontidæ and Desmognathidæ are departures from the *Ambystoma* stem while from these the Sirenidæ and *Amphiuma* seem to be degenerated. *Diemictylus* and *Triton* are identical with regard to these ear structures and differ from all others. They are to be considered the most specialized. Between *Diemictylus* and *Triton* on the one hand and the Ambystomidæ on the other *Salamandra* stands intermediate, resembling more strongly the Ambystomidæ.

Morphology of the Sound-transmitting Apparatus in the Amphibia: B. F. Kingsbury and H. D. Reed, Cornell University.

Study of serial sections and models of representatives of eight families and seventeen genera of tailed amphibia has shown that there are two skeletal structures fitting in the fenestra vestibuli. The first of these, which we designate as the columella, is connected with the cephalic edge of the fenestra when a connection exists between the ear capsule and columella at all. It bears a more or less well developed process primarily connected with the squamosal bone in *Necturus, Proteus* and *Cryptobranchus*. In adult *Ambystoma, Amphiuma* and *Siren* there is a secondary connection of this process with the quadrate. The second element, which we designate as the operculum, has no skeletal connections but affords attachment to a muscle, the m. opercularis of Gaupp. When attachment of this element to the ear capsule occurs it is with the caudal margin of the fenestra. The cephalic end of the operculum is included within the lips of the fenestra vestibuli while in its caudal extent it protrudes. This is the type found in *Diemictylus* and *Triton*. In the larval *Ambystoma*, at transformation, the columella becomes incorporated with the ear capsule while from the latter the operculum is cut out essentially by an extension of the fenestra vestibuli. In the adult of some forms, *e. g., Diemictylus* and *Triton*, only the operculum is present while in others, *e. g., Ambystoma* and *Salamandra*, both elements are represented. In still other forms such as *Plethodon* and *Gyrinophilus* both columella and operculum seem to be present and very closely associated, although the developmental stages upon which the final explanation of the morphologic relations depends have not yet been examined.

On the Effects of Centrifugal Force on the Development of the Eggs of the Frog and Sea Urchin: J. F. McClendon, University of Missouri.

The unsegmented egg of *Rana pipiens* subjected to a centrifugal force = 2,771 × gravity for several minutes, is separated into three layers as follows: a centrifugal yolk layer containing the black pigment granules, an intermediate protoplasmic layer (containing the nuclear elements) and a centripetal fatty layer colored with yellow pigment. Egg material was centrifuged in mass and enough of each layer obtained for certain chemical analyses. Morgan found in 1902 that a certain amount of centrifuging prevented the centrifugal layer from developing. When subjected to more centrifuging no part of the egg develops. When the centrifuged egg partially develops, the centripetal and intermediate layers are more or less mixed in the early cleavage, so I have in the following tables added together the analyses of the centripetal and intermediate layers under the name of the former. Table I. gives the per cent. of water (W.) and solids (S.) in the layers. Table II. gives the per cent. of extracts (E.E. = ether extract, A.E. = alcohol extract, W.E. = water extract) and residue (R.) in the solids. Table III. gives the per cent. of phosphorus (P.) in the extracts and residue. Cp. = centripetal and Cf. = centrifugal layer.

TABLE I.

Layer		W.	S
Frog:	Cp.	74	26
	Cf.	48	52
Arbacia:	Cp.	88	12
	Cf.	79	21

TABLE II.

Layer		E.E.+A.E.	W.E.	R.
Frog:	Cp.	51	34	15
	Cf.	30	10	60
Arbacia:	Cp.	49	20	31
	Cf.	38	10	52

TABLE III.

Layer		P. in E.E.+A.E.	P. in W.E.	P. in R.
Frog:	Cp.	0.018	1.0	0.4
	Cf.	0.54	1.2	1.3
Arbacia:	Cp.	2.36	17.0	3.2
	Cf.	2.74	13.0	1.6

In Tables I.–III. it is observed that there are great differences between the composition of the two layers, and this is correlated with their different capacity for development.

If the egg of *Arbacia* be centrifuged it is separated first into two and later into four layers. By freezing and crushing the eggs and centrifuging in mass I obtained two layers corresponding to the two first obtained in the entire egg. Centrifugal force has little effect on the development of the egg of *Arbacia*. By inspecting the last two lines in Tables I.–III. it will be noticed that there is very little difference between these two layers in composition, and this is correlated with the fact that there is little difference in their capacity for development.

Centrifugal force causes flattening of the mitotic

figures in the frog's egg in the direction of the force. This effect of the force is due apparently to compression of the alveolar framework of the egg, on one side by the fatty layer and on the other by the yolk layer.

Regeneration and Growth in Fishes: G. G. SCOTT, College of City of New York.

The caudal fin of 117 *Fundulus heteroclitus* of sizes varying from 4.57 cm. to 9.73 cm. long was removed. Fins of the younger fishes (shorter) regenerated proportionately more than the older (longer). In fact the curve representing the proportional amount of regeneration in fishes of different ages (lengths) was regularly descending, reminding one of curve of growth established by Minot. One might conclude that regeneration paralleled growth, *i. e.*, that the power of regeneration is greater in the young. On closer examination we find that each fish (regardless of length) regenerated about 0.6 cm. The following explanation is offered: Regeneration of new fin tissue is due to proliferation outwards in a linear direction of new cells arising from the division of cells exposed by the line of amputation. A fish 5 cm. long contains same sized cells as a fish 10 cm. long and the probability is that the power of proliferation is about the same in the cells of fishes of each size—provided that the cells are at the same relative level in each case. When the amputation was made the author endeavored to have line of removal at same relative place in all specimens. Evidence as to the similar powers of regeneration residing in cells of same level independent of size (age) is shown by the fact that actual regeneration outwards in a linear direction is same in fishes of all sizes. This indicates that regeneration is a process independent of general growth processes. It comes into play under abnormal conditions.

The Early Development of Neurofibrillæ and Nerve Function: HANSFORD M. MACCURDY, Alma College, Alma, Mich.

With the purpose to find the earliest stage at which neurofibrillæ may be discovered in the developing nerve cells and the relation between their first appearance and the establishment of conduction paths as evidenced by the earliest normal movements and reactions to external stimuli, observations were made on the larvæ of *Rana* and *Amblystoma*. Neurofibrillæ are present in the earliest optic nerve fibers and in the retinal elements long before they can perform their regular function. That they are also present in early fiber tracts of the neural tube, preceding normal movements seems amply demonstrated, but further confirmation is to be sought. It appears altogether probable that the neurofibrillæ arise practically contemporaneous with the outgrowth of the nerve fiber.

Regeneration in the Brittle-star Ophiucoma pumila, with Reference to the Influence of the Nervous System: SERGIUS MORGULIS, Cambridge, Mass.

1. Is the presence of the nerve essential for the regeneration of the arms in the brittle-star *Ophiucoma pumila?* To answer this question the radial nerve was injured by a red-hot needle near the disc, and then the arm was cut off about the middle of its length. As a control experiment another arm in the same specimen was also cut off at the middle, but its radial nerve was left intact. It was found that in the course of thirty days the arms with radial nerve intact had all regenerated normally, while those with the radial nerve injured produced only a very minute stump of new tissue. If, however, the arm broke off at the place where the nerve was injured—as occasionally happened soon after the operation—no tissue was regenerated from such an exposed surface, although arms in which the radial nerve was intact, even in the same animal, did regenerate.

2. What is the relation of the rate of regeneration to the "level" at which the arms are cut off? It was found that arms cut off at the base or at the middle regenerate much faster than those cut off at the tips.

3. What is the relation of the rate of regeneration to the number of arms removed? The removal of different numbers of arms influences the rate of regeneration of the lost arms only to a small extent; the rate of regeneration when four or five arms are removed is somewhat greater than when one, two or three arms are removed; but this correlation between the degree of injury and the rate of regeneration is not of the nature of a close parallelism.

MAURICE A. BIGELOW,
Secretary

TEACHERS COLLEGE,
COLUMBIA UNIVERSITY

SOCIETIES AND ACADEMIES

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

THE 432d regular meeting of the society was held April 6, 1909, President Hough in the chair. The following program was presented:

New Chapters in the History of the Cocoanut Palm: DR. O. F. COOK.

It has long been thought that the cocoanut palm presents a perfect example of adaptation to a littoral environment, but this idea is delusive. The tough outer rind which is popularly supposed to have been developed as a protection against sea water is really to guard the cocoanut when it falls, and give it favorable conditions for germination. Cocoanuts require a certain amount of salt in the soil, but this condition is satisfied by soils in some interior localities as well as on the seacoast. Considerable sunshine is also needed. This, however, is met better in arid regions than by a coastal habitat and the care with which the milk is protected would argue in the same direction. Far from being a wild plant the cocoanut does not appear to thrive long away from human beings and in spite of the supposed diffusion of the tree by oceanic currents no instance of the kind is known. A consideration of the varieties of cocoanut palms and the method of their occurrence points in the same direction. Against De Candolle's hypothesis of an old world origin for the cocoanut the speaker brought forward documentary evidence that this palm was spread much wider in America than De Candolle had supposed, so widely as to preclude the possibility of a recent introduction into America. On the other hand, certain Polynesian traditions were cited pointing to an eastern origin for the cocoanut trees among the inhabitants of the Pacific islands.

Mr. Safford in discussing the paper contended for an East Indian origin. He called attention to the intimate connection between this tree and the entire social and economic fabric of Polynesian culture. The absence of cocoanuts from Peruvian graves he considered a strong argument against an American origin and the Polynesian traditions cited by Dr. Cook, he thought, were due to the fact that the oceanic currents in the mid Pacific set westward, leaving wreckage, etc., upon the eastern coasts of the islands. While agreeing with the speaker regarding the origin of the cocoanut in an arid country and its adaptation to human needs through human agency Professor McGee believed that we are very far from the end of the problem which it presents. Dr. Folkmar also discussed the paper briefly and Dr. Cook made a short reply to the criticisms and questions.

Cannibalism in Polynesia: Arthur P. Rice.

Mr. Rice remarked upon the wide distribution of this custom and the fact that it had survived to modern times more particularly in Polynesia. Within this area, however, great differences are presented. While Fiji is the classic land of cannibalism, the very next group, the Tonga Islands, lacked it entirely; it was a common practise in the Marquesas Islands, but held in abhorrence in Hawaii. In Fiji the custom was a part of the state religion and was demanded by the gods. Revenge upon enemies was the most constant reason for exercising it, but each island kept a black list from which victims were taken on occasion. Those who died a natural death and chiefs were never eaten. Cases were also cited from New Caledonia, the New Hebrides, Samoa and New Zealand. The absence of animals from which a sufficient meat diet could be obtained was cited as a probable stimulant to the great extension of cannibalism over the Pacific, and the modern introduction of such animal diet a contributing cause to its extinction. A partial compensation for the evils of this custom is to be found in the knowledge of human anatomy thereby acquired and the surgical skill resulting, for which the Maori, at least, were noted. The paper was discussed briefly by Dr. Swanton.

The meeting concluded with an exhibition of a collection of Chitimacha baskets recently acquired by the National Museum through Mrs. Sidney Bradford, of Avery Island, La., and an explanation of the designs upon these by the secretary of the society.

John R. Swanton,
Secretary

THE WASHINGTON CHEMICAL SOCIETY

The 190th regular meeting of the society was held at the Cosmos Club on Thursday evening, April 8, President Walker in the chair. The attendance was 57.

Professor F. W. Clarke gave a talk in memory of Professor Wolcott Gibbs. Professor Munroe, Professor Chatard and Dr. Benjamin related some personal reminiscences of the noted chemist.

Announcement was made that a special meeting of the society would be held at the Johns Hopkins University at Baltimore on April 24. The society granted to the American Chemical Society a waiver of jurisdiction over Virginia, except that part of the state within a radius of twenty-five miles from Washington. Dr. F. C. Cook was appointed the delegate to represent the society at the Seventh International Congress of Applied Chemistry at London.

J. A. Le Clerc,
Secretary

Bureau of Chemistry,
Washington, D. C.